THE CHEMIST

25

TWENTY-FIFTH ANNIVERSARY

PAST PRESIDENTS

FOSTER D. SNELL
(1946—48)

GUSTAV EGLOFF
(1942—46)

HARRY L. FISHER
(1940—42)

ROBERT J. MOORE
(1938—40)

MAX. TOCH
(1936—38)

M. L. CROSSLEY
(1934—36)

HENRY G. KNIGHT
(1932—34)

F. E. BREITHUT
(1928—32)

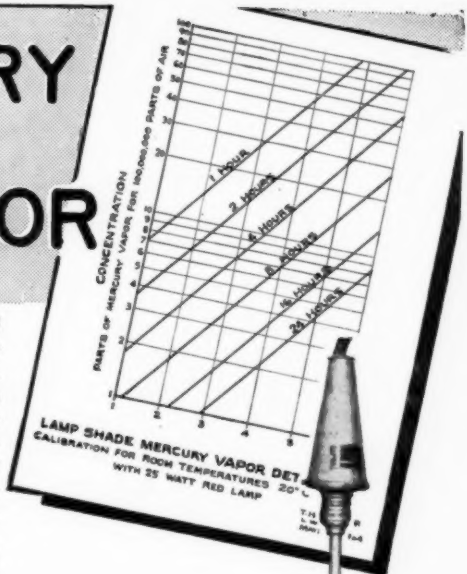
TREAT JOHNSON
(1926—28)

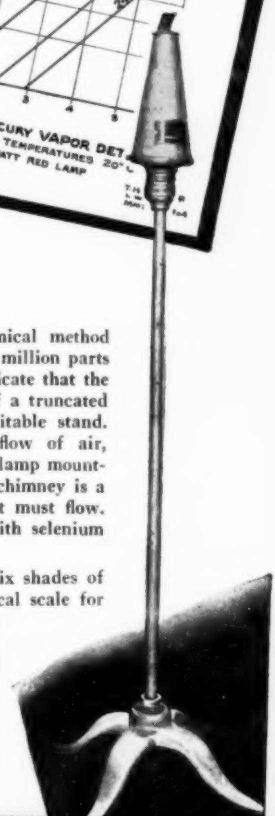
M. L. CROSSLEY
(1924—26)

HORACE G. BYERS
(1923—24)

MAY 1948 VOLUME XXV No. 5

MERCURY VAPOR DETECTOR





The toxic concentration point of mercury vapor in the laboratory atmosphere is surprisingly low. The health of laboratory workers may be endangered unknowingly by vapors arising from open containers of mercury or spilled droplets hidden in laboratory crevices. The toxic limit for continual breathing, as established by the American Standard Association (Report Z 37.8—1943), is 1.3 parts of mercury vapor in 100 million parts of air by volume.

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A calibrated color chart with a horizontal scale of six shades of gray for matching with the exposed paper, and a vertical scale for indicating the concentration of mercury vapor in parts per 100 million parts of air are provided with each instrument. When the sensitive paper has been exposed for the required length of time, its color is matched with the nearest of the six shades on the horizontal scale.

No. 20150 Mercury-Vapor Detector is designed for operation on 115 volts, A.C. or D.C. Price..........$62.70

CENTRAL SCIENTIFIC COMPANY

SCIENTIFIC INSTRUMENTS CENCO LABORATORY APPARATUS

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The Chemist

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IN THIS ISSUE

Lack of space has made it necessary to omit or curtail certain regular departments. These will be restored in the next issue of The Chemist.

JUNE ISSUE

Proceedings of the Silver Anniversary Meeting Held May 7, 1948.

"The Scientist as an Administrator"—Medal Acceptance Address—by Dr. Charles Allen Thomas, 1948 Medalist.

"The Professional Activities of Other Societies." Panel Discussion, by Charles C. Wilson, W. A. Mosher, E. Lawrence Chandler, and W. T. Nichols.

Annual Meeting Reports, and other material.

Silver Anniversary articles, recounting chemists' activities during the past twenty-five years, will appear from time to time in 1948 issues of THE CHEMIST.

The Seeds Were Sown

LOOK back at 1923, the year THE AMERICAN INSTITUTE OF CHEMISTS was officially founded. Today's hindsight reveals some of the embryonic events which fruited in the following twenty-five years. Some of these seeds of the future flourished and gave a good harvest; some bore the "flowers of evil". Scattered throughout were also the ephemeral blossoms which give color and perfume to the day and vanish except in memory.

In 1923, World War I had been over for nearly five years. French and Belgian troops occupied the Ruhr. A permanent Court of International Justice was located at The Hague. It was designed to settle disputes between nations, and it served as legal adviser to the League of Nations. Among the nations that did not belong to it were the United States, Russia, and Turkey. A four-power treaty existed between the United States, Japan, Great Britain, and France. Joseph Stalin was a prominent member of the Communist party. On the last day of that year, Nicolai Lenin, in poor health, would live but twenty-one days more. General Ludendorff and Adolf Hitler failed in the "Beer Hall Putsch" at Munich, where Hitler was wounded, then captured and imprisoned at Landsberg Fortress. Benito Mussolini succeeded in becoming temporary dictator of Italy.

In the United States, some of the War's disillusionment lingered. It was the time of prohibition, bath-tub gin, speakeasies, and hip flasks. The younger generation reacted with its own revolt against good-breeding and gentility, and wooed sophistication and world-weariness, which sat uneasily upon its natural enthusiasm. The mental conflict engendered by the antipodal behavior patterns, those of training and those of popular fad, no doubt accounted for the sudden popularity of psychoanalysis. Strangely enough, the best-selling, non-fiction book, was Emily Post's "Etiquette"; the best-selling fiction book, "Black Oxen" by Gertrude Atherton. Numberless persons sought the simple solution to these mental problems, and to save themselves a great deal of personal effort, simply repeated Dr. Emil Coue's formula, "Day by day in every way, I am getting better and better".

The best-liked songs were tuneful and hopeful: "That Old Gang of Mine", "Carolina in the Morning," "My Gal Sal," "Feather Your Nest,"

"It Ain't Gonna Rain No More," "Let the Rest of the World Go By," "Tuck Me to Sleep," "Barney Google," and "Yes, We Have No Bananas."

Ladies' skirts became a little shorter—four inches above the ankle. Stockings changed from black and white to flesh-color. The fashion of wearing bobbed hair began to be accepted.

In sports, the New York Yankees won over the N. Y. Giants in the World Series. Harry Heilmann of the Detroit Tigers led the American League in batting, and Roger Hornsby, the National League. Dempsey defeated Tom Gibbons and knocked out Luis Firpo. William T. Tildon, 2nd. was tennis champion, and Helen Willis won the Women's National Tennis Championship. Bobby Jones took the National Open Championship in golf. Southern California beat Pennsylvania in the Rose Bowl at Pasadena.

The movies, all silent then, featured such films as Cecil B. De Mille's lavish, "Ten Commandments"; "Salome" with Nazimova; "The Eternal City" with Barbara La Marr and Lionel Barrymore; "The Perils of Pauline" with Pearl White; "Little Old New York" with Marion Davies; "The Hunchback of Notre Dame" with Lon Chaney; "Safety Last" with Harold Lloyd; "Anna Christie" with Blanche Sweet; "The Green Goddess" with George Arliss and Alice Joyce. William S. Hart was tops in the Westerns. "The Covered Wagon" was then only a serial in the *Saturday Evening Post.*

The stock market fell during much of the year, but began rising toward the end. There were an estimated 1,500,000 persons unemployed. Nearly ten million motor vehicles were on the roads, supplemented by twenty-million horses. The popular car was the Ford Model T. Automobile manufacturing was rapidly expanding and with it the related fields of petroleum, road-construction, trucking, buslines, and building. Suburban developments were being promoted and real estate was in a boom period. The radio industry was also a fast-growing infant. Some 550,000 radio sets were in use, most of them equipped with earphones. The first network broadcast was made by linking Stations WEAF and WNAC.

President Warren G. Harding died in San Francisco while he was returning from a visit to the new, government-operated Alaska Railroad. Calvin Coolidge vice president, succeeded him. Harry S. Truman was completing four years as operator (with Ed. Jacobson) of a men's furnishing store in Kansas City. John L. Lewis was president of the United Mine Workers. Douglas MacArthur was completing his final year as superintendent of West Point. Dwight D. Eisenhower held the rank of captain. John J. Pershing was General of the

Armies of the United States. Franklin D. Roosevelt was still recovering from an attack of infantile paralysis, suffered in 1921.

On September first, a disastrous earthquake struck Japan, leaving only two buildings standing in the City of Yokohama.

The 1923 Nobel Prize in chemistry went to Fritz Pregl, and that for physics to R. A. Millikan.

Following 1923, came six years of prosperity, ten years of depression, five years of war, and three years of post-war uncertainty, bringing us to 1948.

For some of the things which chemists were doing from 1923 to 1948, see the articles which follow.

Polytechnic Institute Conference

Polytechnic Institute of Brooklyn, New York, held a conference on April 24th, under the auspices of its Division of Applied Physics and its Institute of Polymer Research. Dr. Isidor Fankuchen, who is the first incumbent of the new chair of Applied Physics there, presented a paper on "X-ray Diffraction Evidence of Long Range Forces in Preparations of Tobacco Mosaic Virus." Other speakers were the Nobel prize winners, Dr. Peter Debye, chairman of the Department of Chemistry at Cornell University and chairman of the conference, and Dr. Irving Langmuir of General Electric Company.

Alpha Epsilon Delta Convention

Alpha Epsilon Delta, national honorary premedical fraternity, held its Eight National Convention, the first to be held since the war convention of 1942, with the Chapter at the University of Colorado, March 25th to 27th. A symposium on Premedical Education included as speakers Dr. Norman F. Witt, national treasurer of Alpha Epsilon Delta; Dr. Robert L. Stearns, president of the University of Colorado; Dr. Ward Darley, dean of the University of Colorado School of Medicine, whose talk was "Desirable Personal Attributes of the Physician"; and Dr. Hugh E. Setterfield, national president of the fraternity, and professor of anatomy at Ohio State University School of Medicine, who presented a paper on "Ancillary Medical Services."

The following national officers of the fraternity were elected: national president, Dr. Hugh E. Setterfield; national vice president, Dr. Eric Faigle, associate dean, Syracuse University; national secretary-historian. Dr. Maurice L. Moore, F.A.I.C., director of Smith, Kline and French Research Laboratories; national treasurer, Dr. Norman F. Witt, professor chemistry, University of Colorado; national councilor, Dr Emmett B. Carmichael, F.A.I.C., head Department of Physiological Chemistry, Medical College of Alabama.

Synthetic Fuel Production in the USSR.

Dr. V. I. Komarewsky, F.A.I.C., speaking April 14th at Illinois Institute of Technology, stated that Russia is lagging behind the United States in the development of simplified, efficient processes for the manufacture of large quantities of synthetic fuel.

"I have been following the progress of Soviet scientists in the field of synthetic fuel production very closely for over fifteen years," Dr. Komarewsky, who is professor of chemistry at Illinois Institute of Technology, declared, "and I definitely feel that we are far ahead of Russia in the manufacture of synthetic petroleum from natural gas or coal . . .The Soviets are studying the catalysis processes that we are using but I don't think they have made much headway, chiefly because they haven't the reserve of skilled technicians and scientific instrumentalists that we have." (Last year the USSR suddenly stopped the publication of all scientific journals destined for readers outside the country.) "However, we do know that the USSR is now devoting much of its attention to the low temperature carbonization process which can produce 80-octane gasoline from peat and brown coal, of which they have large stocks. Just how successful they have been is becoming harder and harder to determine."

University in Hungary Seeks American Contacts

Peter Pazmany University, Budapest, Hungary, has formed an American Institute, designed to foster and propagate American culture with special emphasis on American intellectual and economic conditions and scientific investigation, and to secure contacts with U. S. scientific circles. One of its aims is to establish a library consisting of U. S. periodicals and books.

Hartung on Staff of North Carolina University

Dr. W. H. Hartung, professor of pharmaceutical chemistry at the University of Maryland for the past twelve years, is leaving to take a position at the University of North Carolina, Chapel Hill, in the fall of 1948. He is a graduate of the universities of Minnesota and Wisconsin, and for ten years was research chemist with Sharpe and Dohme. He is a charter member and past chairman of the Baltimore Chapter, A.I.C.

Herty Medal Presented to Dr. Rudd

The Herty Medal of the Georgia Section of the American Chemical Society was presented to Dr. Wortley F. Rudd, dean emeritus of the School of Pharmacy, Medical College of Virginia, at a meeting on May first, at Georgia State College for Women, Milledgeville, Georgia.

Early History of The American Institute of Chemists

Dr. Lloyd Van Doren, F.A.I.C.

Secretary, A. I. C.

—BACHRACH

PAST PRESIDENT
Dr. Horace G. Byers
1923-1924

THE American Institute of Chemists was the outgrowth of a movement which had its inception in the New Jersey Chemical Society. In June of 1921, the secretary of the New Jersey Chemical Society, Dr. F. D. Crane, announced that active steps were being taken to promote a movement for the organization of The American Institute of Chemistry. At that time it was stated:

"Our model in organization will be, so far as we can now see, that of the Certified Public Accountants. We want to put chemists on this plane. We want all the suggestions we can get. We want to lay our foundation broad and deep and stable enough to carry any number of chemists in every branch of industry."

The organization work was continued and in the early part of 1922 such progress had been made that the following statements were published:

"Purusuant upon the conviction of a large number of the younger element of chemically trained men in New York City that if a project is worthy of consideration, and being found good, it equally is worthy of being carried into execution, initial steps are now under way to organize the American Institute of Chemistry . . .

"Organization will be effected under the membership corporation law of the state of New York. This will provide not only the maximum dignity and assurance of corporate permanency, but will compel the interest

—BLACKSTONE STUDIOS

PAST PRESIDENT
Dr. M. L. Crossley
1924-1926 and 1934-1936

of all chemically trained men in chemical enterprise throughout the state . . .

"Let it be understood clearly that the American Institute of Chemistry is an organization of a professional character with fundamentally economic purposes as related to the development of the potentialities of chemically trained men. It complements and correlates the functions of the American Chemical Society as our scientific organization . . .

"The American Institute of Chemistry aims to be a humanitarian economic society to which each member can turn as a matter of right for service to be rendered as a matter of duty—on the one hand without embarrassment or apology, and on the other without subterfuge or evasion. The American Institute of Chemistry will play no favorites . . .

"The desire for an organization which would hold together the chemists of the country and would define the status of the chemical profession has been evident for a considerable length of time to any reader of the scientific press. During the war period there was a general recognition on the part of the public of the necessity of the chemist in modern warfare. Since then there has been cultivation of popular appreciation of his great part in civilization. To thousands in Canada there came for the first time the realization that there was a difference between the druggist and the chemist.

The Need For a Professional Organization

"No one denies that the present condition of the chemist is unsatisfactory; the total lack of any criteria as to what constitutes a chemist is a fact too well known to require discussion . . .

"The advantages of a closed society in the raising of the status of a profession is exemplified in the medical associations of this country and of England. To anyone familiar with the books describing the conditions of a hundred or even fifty years ago, the difference in the prestige of the medical practitioner and his place in the mind of the people is remarkable. A

large part of this undoubtedly is due to the work of the medical associations and to the care exercised in admitting men to the ranks of the physicians.

"In our own profession we have an example in the work of the Institute of Chemistry of Great Britain. The letters F. I. C. or A. I. C. stand for work accomplished. They are recognized throughout the world as carrying as much if not more weight than a university degree, for they stand for principles which have been put into practice. Still nearer home we have the lately constituted Canadian Institute of Chemistry, which follows closely on the lines of the earlier English organization.

"The idea of a Canadian Institute of Chemistry was evolved by chemists during meetings of the Society of Chemical Industry. The need of a purely professional organization to deal with questions applying to chemists only had been felt for some time . . .

"The usefulness of a similar institute of chemistry in the United States is evident. It should supplement the work of the American Chemical Society and should not conflict with it any more than the Canadian Institute of Chemistry conflicts with the Society of Chemical Industry. It could do much to obtain for the chemist the recognition he should have from the general public, and also could arrange for recognition for the

—YALE UNIVERSITY NEWS BUREAU

PAST PRESIDENT

Dr. Treat B. Johnson

1926-1928

individual chemist who, without university degrees, has worked in some particular field of chemistry and has high standing among those who know his grasp of the subject. Such a society should tend also to promote fellowship between chemists of this country and those of Canada and Great Britain—an ideal well worth the attainment. These results would not all be accomplished in a day by the American Institute of Chemistry, but assuredly the organization would be a step in the right direction."

First Organization Meeting

The initial organization meeting was held January, 1923, and as a result a strictly professional society

PAST PRESIDENT
Dr. Frederick E. Breithut
1928-1932

of chemists came into existence and began to function. Its first work was the formulation of a constitution; the election of a temporary board of officers, and the appointment of certain committees.

Relative to the initial organization, it was stated that,

"No project in American chemistry has ever been discussed with greater interest or with such wide-spread measure of approval as the one looking to the establishment of a society which, without duplication of the functions of any existing society, would dedicate itself solely to the organized study of the material problems of chemists, and which would serve the great body of chemically trained men along the same lines as the bar association serves the lawyer and the medical society the physician."

Purposes

At that time the purposes of The American Institute of Chemistry were stated to be:

"To inculcate independence in the practitioner of chemistry by demonstration in every ethical way of the advantages of economic cooperation by the class.

"To establish standards of capacity.

"To promulgate a code of ethics.

"To increase the opportunities for the effective use of the services of trained chemists.

"To promote the material welfare of the practitioner of chemistry wherever he may be and to aid and protect him in the solution of the problems of his profession.

"To give the work of the chemist the professional status its importance to society demands.

"To promote popular appreciation of that status by the cultivation and display of ability to work cooperatively in all matters having to do with improvement of employment conditions and the advancement of the welfare of chemists."

A temporary board of officers was selected to serve until the first Annual Meeting: Horace G. Byers, president; Lloyd Van Doren, vice president; Clarence K. Simon, treasurer; and Lloyd Lamborn, secretary.

Among those at this first meeting were, Charles V. Bacon, F. D. Crane, R. S. Doubleday, A. Willard Joyce, Harry L. Lourie, Adrian Nagelvoort, Albert P. Sachs, L. R. Seidell, Nathan Smith, and H. P. Trevithick.

Second Organization Meeting

The second and concluding organition meeting was held in New York on February 5, 1923. Among those who were in attendance and formally expressed their desire to affiliate with the professional society of chemists were, Sidney M. Cadwell, Harold A. Fales, Casimir Funk, Louis Freedman, Calm M. Hoke, Robert J. Moore, R. M. Meiklejohn, C. N. Meyers, and Thomas A. Wright.

The following letter was received from Harold J. Roast, F.C.S., F.C. I. C., first secretary of the Canadian Institute of Chemistry:

Gentlemen of the American Institute of Chemistry:

Let me congratulate my professional confreres in the United States upon the success that has attended their efforts to bring into being a truly professional and representative body of organized chemists.

Might suggest in the friendliest spirit that consideration be given to the matter of the letters used to designate membership.

We shall now have Fellows and Associates of the Institutes of Chemistry of Great Britain,

PAST PRESIDENT
Dr. Henry G. Knight
1932-1934

Canada and America represented by the respective designations F.I.C. and A.I.C., F.C.I.C. and A.C.I.C., and F.A.I.C. and A.A. I.C.

With the best and sincerest of good wishes for what will undoubtedly be the successful development of the American Institute of Chemistry, I am,

Yours sincerely,

HAROLD J. ROAST

First Regular Meeting

The first regular meeting of the American Institute of Chemists was held April 9, 1923. Dr. H. G. Byers, president, presided and opened the meeting with the following remarks:

—UNDERWOOD & UNDERWOOD
PAST PRESIDENT
Dr. Robert J. Moore
1938-1940

"When The American Institute of Chemistry was organized, some of us at least felt that it would take some time to make American chemists realize the need of a cooperative agency which would distinguish between the direct welfare of the chemists and the indirect advantage coming from the development of the science and industry. We expected both opposition from established organizations and more or less apathy on the part of those who should be most interested. We also expected to encounter difficulty in financing the organization expenses. Certainly we never expected to experience growing pains so soon after birth.

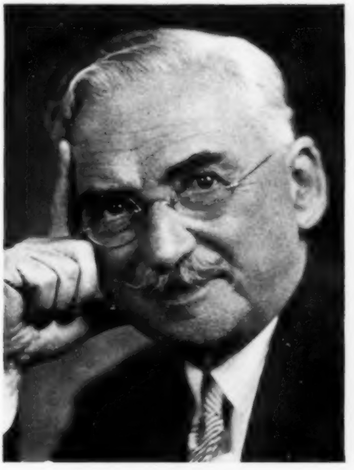
"The reports of your Secretary and Treasurer will show that our organization difficulties are of a different sort. The organization was expected to develop from a center outwards. Instead it has started up with members located in practically every state from coast to coast. There are going to be no difficulties about expenses or the stimulation of enthusiasm. Instead there are already and are going to be great difficulties in properly safeguarding the membership from those not worthy of inclusion."

Charter Members

The following Charter members of The American Institute of Chemistry, those elected up to March 31, 1923, inclusive, are still with the organization in 1948:

William S. Arnold
Charles V. Bacon
Jay Bowman
Horace G. Byers
Eugene J. Cardarelli
Hugh B. Corbitt
William J. Cotton
James F. Couch
Lloyd L. Davis
Ralph B. Deemer
Gabriel D'Eustachio
Ralph S. Doubleday
Charles R. Downs
Edwin Dowzard
Harry E. Dubin
Jacob Ehrlich
Albert K. Epstein
Louis Freedman

John Gaub
Calm M. Hoke
Norris R. Kosches
A. C. Lansing
Ralph E. Lee
Stewart J. Lloyd
Harry L. Lourie
Roy M. Meiklejohn
Simon Mendelsohn
George E. Merkle
Joseph R. Minevitch
Jack P. Montgomery
A. J. Pastene
Alfred M. Peter
Albert P. Sachs
Nathan Smith
Richard C. Smith
John A. Steffens
W. L. Tanner
James N. Taylor
Lloyd Van Doren
Glenn H. Wagner
John M. Weiss
Leonard Wickenden
Robert A. Worley
Frederick W. Zons

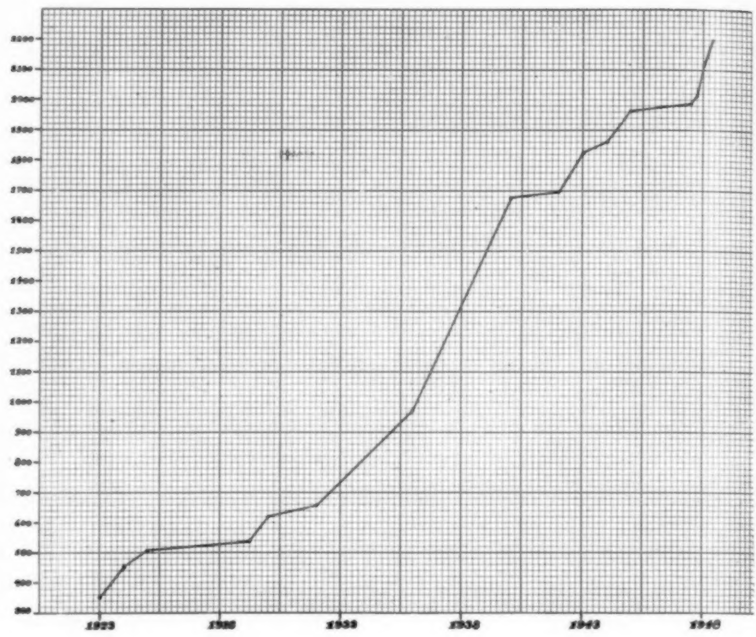


PAST PRESIDENT
Dr. Maximilian Toch
1936-1938

Second General Meeting

The second general business meeting was held on September 20, 1923, at which Arthur C. Neish and L. E. Westman, president and secretary of the Canadian Institute of Chemistry, were present. This meeting was signalized by the formal recognition of the Institute by The Canadian Institute of Chemistry which was the offspring of the parent economic professional society of chemists, the Institute of Chemistry of Great Britain and Ireland, and by the legal formalities preliminary to incorporation as The American Institute of Chemists.

Dr. Byers, president, announced the proposed change in name from The American Institute of Chemistry to THE AMERICAN INSTITUTE OF CHEMISTS, as more correctly indicating its character and as expressing the fact that in the United States the appellation "chemist" was not confined legally to the dispenser of drugs as in Great Britain. The change in name was unanimously approved and steps were taken to incorporate under the Membership



A.I.C. Membership as of April 1, 1948.

(Total membership on May first is 2227.)

Corporation law of the State of New York.

First Honorary Member

Also at this meeting, Dr. Charles Frederick Chandler, who had expressed much interest in the aims of the INSTITUTE and had encouraged its formation, was elected as the first Honorary Member.

The membership of the INSTITUTE, as reported at that meeting, was 405, of which 308 were Fellows, 72 were Associates, and 5 were juniors. (For the growth of the A. I. C. during the past twenty-five years, see the accompanying graph.)

In May of 1923, a mimeographed *Bulletin* was started, under the editorship of Calm M. Hoke.

Incorporation

THE AMERICAN INSTITUTE OF CHEMISTS was incorporated under the Membership Corporation law of the State of New York in 1926, and

—ING-JOHN

PAST PRESIDENT
Dr. Harry L. Fisher
1940-1942

—KAUFMAN & FABRY CO.

PAST PRESIDENT
Dr. Gustav Egloff
1942-1946

it continues to function under and by virtue of said law.

First Medalist

The gold medal of The American Institute of Chemists was founded in 1926, the Committee on Medal Design being Albert P. Sachs and Calm M. Hoke. The first medalist was William Blum of the U. S. Bureau of Standards, Washington, D. C.

The Emblem

The A. I. C. emblem was designed by D. D. Berolzheimer who derived it from an alchemical symbol meaning "the essential thing," surrounded by a circle to indicate "all inclusive." The essential thing to the advancement of the professional status of chemists is a strong professional organization.

Motion Picture Films

The Water and Sewage Works Manufacturers Association, Inc., 170 Broadway, New York 7, N. Y. has on file details regarding thirty-four motion picture films of interest to water works, sewage works, and other engineering and chemistry fields. Information concerning these films may be obtained from the association.

Student Medals Awarded

The Chicago and Niagara Chapters of THE AMERICAN INSTITUTE OF CHEMISTS have awarded student medals for 1948 to the following students "in recognition of leadership, excellence in scholarship, and character".

Chicago Awards

William Boyer
Illinois Institute of Technology.

Keith Henry Edmondson
Purdue University

Kenneth L. Lindsay
University of Illinois

Glenn O. Michaels
The University of Wisconsin

Joseph Lloyd O'Brien
University of Notre Dame

Elio Passaglia
Northwestern University

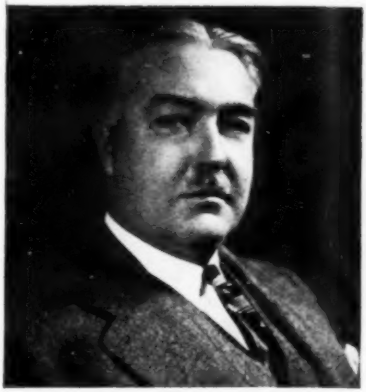
Raymond Charles Sangster
The University of Chicago

Niagara Awards

Jonathan L. Bowen
Niagara University

Charles W. Koethan
University of Buffalo

Edward N. Weber
Canisius College



RETIRING PRESIDENT
Dr. Foster D. Snell
1946-1948

Symposium on Water and Waste Treatment

The Ohio Valley Section of the American Institute of Chemical Engineers announces that a symposium on "Water and Waste Treatment" will be held at the Engineering Society Headquarters Building, Cincinnati, Ohio, on October 16th. During the summer the Ohio River Valley Water Sanitation Compact will become effective, committ'ng the eight states comprising the river system to a program of stream pollution abatement. This symposium is planned to disseminate technical information essential to the solution of stream sanitation problems.

The Professional Status of Chemists

Dr. Walter J. Murphy, F.A.I.C.

Editor, Industrial and Engineering Chemistry, Analytical Chemistry, Chemical and Engineering News.

A QUARTER of a century ago sounds like a long time. To the Founding Fathers of THE AMERICAN INSTITUTE OF CHEMISTS the year 1923 seems but yesterday, yet many profound changes in the professional status of chemists have taken place in that period—although to some, Utopia may yet seem to be far off, perhaps just a succession of disappointing mirages.

Who is best fitted to say whether the evolutionary changes which have occurred since the INSTITUTE was established can be labeled progress? Surely, it is those members who banded together twenty-five years ago to found an INSTITUTE whose primary objective was to improve the professional and economic status of chemists. Judged by most any standard, these men and women should be specially qualified to testify.

The editor of THE CHEMIST recently polled the 25-year members of the INSTITUTE on the question, "In Your Opinion Is The Professional Standing of Chemists Better Today Than It Was in 1923?"

Twenty-eight replies were an unqualified "Yes". Thirteen thought it was a great deal better. Sixteen thought it had improved in some ways but not in others, and five replies were in the negative. Percentage-wise, it would appear that those who are now in middle-age or older generally are of the opinion that the past quarter of a century—the period of great expansion of the profession in the United States—have been years of progress and solid achievement. However, it is equally clear that much still remains to be accomplished. Indeed, who would be so bold as to say that there is some point in the future where we can rest on our laurels with complete contentment, boasting we have at last arrived? Our effort must be of a continuing nature and must be wisely expanded.

In any evaluation of the gains of the past twenty-five years, and in any comparison made with other learned professions, we must realize that chemistry is relatively a newcomer, despite the fact that in the 17th and 18th Centuries, a comparatively few individuals made spectacular scientific

contributions and, as pioneers, paved the way for the notable achievements that are now everywhere in evidence. It was not till the latter part of the 19th Century that the groundwork was laid in America for a chemical profession as we know it today, and not until the last quarter of a century did our profession really experience the phenomenal growth which we view justifiably with great pride.

We are members of one of the newer professions when we compare it to religion, law, medicine, and teaching. Yet it is not an over-statement to say that during the past twenty-five years the chemical profession has moved forward at a more accelerated pace than most other professions. Starting later we are gaining rapidly. We should be optimistic rather than pessimistic, for ours is one of the most dynamic fields and the opportunities are almost unlimited. Dr Vannevar Bush most appropriately defined science as the "endless frontier."

Professional status is not easily defined. Essentially, it is an intangible thing. Certainly, it is something that must be earned by each individual the hard way. Public recognition and appreciation cannot be bestowed by government edict. Legislatures may define what a profession is for legal purposes, but that which we seek primarily is esteem and prestige. The noisy calliope brings a curious crowd to the circus parade but when the show is over and the tents struck, the public promptly forgets until it again hears the strains of Yankee Doodle.

The Public Recognizes Chemists' Achievements

Prior to World War I, the American public was almost wholly unconscious of the chemical profession. Today, the lay-public is vitally interested in the products of chemical research. Some will point out that there is a difference between an interest on the part of the public in the fruits of research and a direct interest in the chemical profession as such. We have no "Babe Ruths" nor "Joe Louises". We have not reached the stage where 100,000 people will pack a research laboratory on Sunday afternoon, paying anywhere from $1 to $4 to watch a Pauling, a Urey, or a Seaborg perform at the laboratory desk. I doubt whether such an objective is attainable, or that it is wise to attempt a Roman holiday approach.

The lay-public's opinion of the chemical profession is based, not on any hysterical, momentary hero worship of one or more individuals, but rather on a solid foundation of deep appreciation of the services rendered to mankind. Admittedly, but a very small percentage of the lay-public can name the discoverer of the original sulfa drug, or penicillin, or streptomycin. Very few will be conversant with the exact history of the development of synthetic rubber in the United States, but only the most unintel-

ligent are unaware of the improvement in the standard of living that has been brought about by chemical research. There are two kinds of publicity—favorable and unfavorable. Fortunately, we have had little of the latter.

Let us not be too discouraged because John Q. Public cannot rattle off the names of scientists as he does the names of a dozen outstanding baseball or football players or radio comedians. The average non-scientifically trained individual will probably experience similar difficulty in any attempt to name ten outstanding surgeons, sociologists, artists, lawyers, dentists, or college professors.

The first objective in a dignified approach to the problem of publicizing the chemical profession is to inform every man, woman or child about the products developed in our laboratories and their applications to everyday life.

As director of the American Chemical Society's News Service, I can testify to the fact that today no profession in America receives as much favorable publicity of this type as does the chemical profession. It is likewise true that we are making great strides toward the goal of publicizing the individual achievements of the chemist, and today, the Coris, the Thomases, the Paulings, and the Seaborgs are making headlines in the country's newspapers, national weeklies, and over the radio.

The Chemist Receives Wider Recognition

The contributions of chemistry to to the general welfare of society, even such a destructive force as the atom bomb, have served to highlight the importance of the chemist. Clearly the profession must—and I am confident that it will—accept greater responsibilities in the political, social, and economic life of the nation. Perhaps the greatest weakness in the past has been the chemists' unwillingness to leave the "ivory tower". Professional status brings with it a number of obligations. It has been encouraging to note during the past quarter of a century an increasing willingness of members of our profession to accept obligations and responsibilities that are part of the role of the truly professional man. We have our obligations to our profession as well as to society. Our scientific, technical, and professional societies are what they are today, only because thousands have contributed time, energy, and financial support.

In abandoning our "ivory tower" attitude we must act objectively and in a manner that will not antagonize others. The mere fact we are scientists does not entitle us to preferential treatment, nor will it automatically influence others to seek our advice except on scientific subjects. Today our opinions and advice are being sought by Congress, government agencies, and the general public. Any assump-

tion of an air of superiority or any indication on our part that we are dogmatic will undo much of the gains that have been made in the last decade or two. Let us bring to social, political, and economic problems the same degree of objectivity that we, as chemists, employ in the laboratory.

Other Professional Gains

What are some of the other gains that have been made during the past quarter of a century? High on any such list is the work of the American Chemical Society's Committee on Professional Training, which has played a prominent role in improving instruction at the college and university level in the fields of chemistry and chemical engineering. And certainly, the professional status of chemists has been enhanced greatly by the phenomenal growth and the activities of our scientific, technical, and professional societies.

The formation of The American Institute of Chemists in 1923 was a memorable step, for the Institute called attention to problems of the profession other than those of a purely scientific nature. Another great forward step was the adoption of professional requirements for membership in the American Chemical Society. Today, the American Chemical Society's membership of more than 57,000 provides a huge umbrella for the chemical profession. Only the American Medical Association exceeds it in total membership among the scientific and professional societies of the world.

Another potent factor in the improvement of our professional status is the variety of scientific, technical, and professional journals, today the envy of the rest of the scientific world. These publications are not only the tools which make possible dissemination of scientific knowledge, but serve also as a medium of exchange of ideas on professional problems.

Improved Employer Recognition

The chemical profession differs from that of law or medicine at least in one important factor—the majority of chemists are employees. It is imperative then, if we are to advance the position of the chemist professionally, to impress employers with the professional character of the work the chemist does. The past ten years particularly have seen a vast improvement in employer-professional employee relations. The chemist of twenty-five years ago worked in surroundings quite different from the well-equipped laboratories of today. Progressive organizations, imbued with a keen appreciation of the professional character of the chemist, encourage their scientific and technical personnel to contribute scientific manuscripts to appropriate journals, and finance frequent attendance at meetings of scientific societies.

Several companies have instituted programs providing for higher posi-

tions for research personnel other than purely administrative work. This is a most desirable move, because the research chemist is very much of the opinion that he is otherwise handicapped by remaining in research. The pattern set by a few companies will stimulate others to do likewise.

Another rather recent innovation is providing a year's absence for advanced study for a limited number of promising young chemists. Again, the example of a few companies will act as a catalyst on others. Even government, which naturally is in somewhat of a straitjacket on such policies, is beginning to broaden and supplement its policies in regard to employer-professional employee relations.

I believe we can look over the past twenty-five years with considerable pride in viewing the accomplishments in that era, but let us not view them with smug complacency. The tasks ahead will require intense continued interest on the part of each and every member of the profession. Each one of us must be much more concerned with what we contribute to our profession, our societies, our publications, and our country than with what we receive in return. Perhaps the greatest mark of a professional man or woman is the services rendered without thought of financial gain.

Some Problems of the Professional

Dr. Hilton Ira Jones, F.A.I.C.

Hizone Laboratories, Wilmette, Ill.

THE best solved of the professional's many problems are those defining what constitutes a profession. One of our engineering societies declares there must be:

1. *A body of knowledge* so large, complex and difficult that one can not stay at home and learn it out of books, and therefore there must be,
2. *Colleges* organized, standardized and accredited where this body of knowledge is taught. There must also be,
3. *National and state associations* of those qualified to practice the art or profession. There must be published by this association,
4. *A magazine* (or more than one) whereby new knowledge may be disseminated, so that the knowledge of one may become the knowledge of all and, finally,
5. There must be an organized system of *state licensure* whereby only those trained and qualified may be legally permitted to practice the art or profession.

The lawyers, physicians, dentists, and pharmacists stand, among others, as the most perfectly organized. The chemists fully meet all these standards except the last one. When called as an expert witness, a chemist is often made to realize his lack of any legal status which the court and lawyers would accept as legally recognized and protected. I have several times been embarrassed that I had to bring in the fact of being a registered pharmacist. This was accepted, while the lawyer contended that anyone could call himself a chemist and advertise himself as such whether qualified or not.

By common practice, we have the laborers on the one side and the professionals on the other and almost without exception the laborers are unionized and the professionals are not. There has been to date no generally accepted union in the professional field. Likewise, we usually have labor on one side and management on the other; chemists and other professionals not being a part of unionized labor are mostly supposed to be a part of management or at least one

of the tools of management. There is, however, much unfavorable confusion at this point. Labor recognizes clearly enough that we are not in their camp and too often management does not realize that the chemists belong with them and consequently we are often just sort of lost in between.

In some professions, such as that of the physicians for example, the general custom is for the professional to hire (borrow) capital. In others, capital hires the professional. With most professions, however, as with the chemists, both systems are in operation. Generally it is the fault of the chemists themselves that they are not always more closely associated with management.

If the professional hires capital, he secures independence, personal freedom of initiative, and he sacrifices security with the hope of greater reward. When he hires himself out to capital he obtains security at the sacrifice of personal liberty and the chance of greater reward which he may or may not actually achieve. If, after selling himself to capital he joins a union, he sacrifices more of personal liberty, freedom of initiative, and personal bargaining rights for the legal rights gained under "collective bargaining." The professional must determine in each case whether the gain compensates for the loss. Just as in taking out a patent, the inventor must determine whether he is willing to give his secret to the public in return for the theoretical seventeen-year monopoly.

The professional status of the chemist is complicated, as most other professionals are not, by the existence of a group called "laboratory technicians." Much of the misunderstanding between chemists and management has grown out of the employment of such technicians in the same laboratory with professional chemists. From the beginning these technicians have fallen under the spell of the C.I.O. organizers and as a result have obtained union pay. The professionals, the real chemists, have not kept themselves sold to management with a result that the technicians have sometimes received almost as good pay as the research men. This has, in a few cases, actually led to the unionization of chemists, not only because of low salaries but often more because of low professional status. The chemist's pride is hurt. He has turned his patents over to management without a bonus or a raise in pay and worst of all, often without thanks.

Creative Work Requires Freedom

The technicians work by a time clock. The best research is never done that way. The great scientific inventions and discoveries mostly come as flashes of illumination. The professional works and studies and dreams and then in some monent of relaxation while fishing, loafing, or often in the early moments of the morning

—Click!—there comes the basic critical idea—worked out by his subconscious thought above the horizon of consciousness when the objective was relaxed. Management should understand this process and so arrange for the conduct of research that the proper conditions may exist for those moments of subjective illumination. After the basic conception has come, mass research may be used to develop the details. For example, Eli Whitney in a moment of inspiration conceived the idea of mass production. It took years of painstaking work by many men to develop it to its present status. Checking in and out by a time clock is one of the major handicaps of basic research. The mind of the researcher works twenty-four hours a day—often the best work being done while he sleeps after the mind has been charged with the problem.

The Need for Professional Societies

Considering the large membership in ACS with the AIChE and the AIC added, one might be led to imagine that all chemists now belong to one or more of these societies, but actually the facts are that little more than half of the people in the country that at least claim to be and call themselves chemists do belong. If these non-joiners were to be found only among the lower grades and the poorly-prepared, the situation would not be so serious, but some research directors with Ph.D degrees do not belong, which makes it clear that there must still be much of the hermit alchemist left among us.

This lack of proper organization still constitutes one of the great problems of the professional. Anyone who has worked with legislatures must fully appreciate that only in numbers (votes) is there strength. Every chemist should be a joiner—that is in the common interest. The situation is improving. Here in Chicago all the chemical groups, numbering some eight, have joined with the engineering and other technical groups, fifty-two in all, in forming the Chicago Technical Societies Council with over 20,000 members. Dr. Gustav Egloff, former national president of The American Institute of Chemists, is our president. There are already fifty-one similar "Scientech" groups, they say, in our larger cities. We are looking forward to the affiliation of all these into a great national technical societies council which should have a total membership of a million or more. Such a body of scientific workers and voters could exert a great political influence that would be invaluable to us all.

Broad Vision Essential

Another one of the problems of the professional that has been evident for a century or so and will be with us for a long time is embodied in the old wheeze about a Ph.D being "a fellow who knows more and more about less and less." In other words,

the continued narrowing of our fields of interest tends to shut us off from the wider view of the part science and technology should play in the development of the more abundant life, as well as in the checking of that dangerous over-centralization of Government, which we call bureaucracy, with its vanishing power of the States. We are inclined to peek at the moss on the bark so closely that we are unable to see the forest. So with all this blinding over-specialization we must maintain a balance by keeping a few leaders with a breadth of vision that will keep the separate sciences welded into one science for the common good, so that all may work less and have more. All such advancement has little value, however, unless in the midst of our narrowing views with its multiplicity of gadgets we retain the power to dream and convert leisure into leadership. Ever-increasing technological efficiency means ever-increasing production and expansion of output. This does not lead to economic stability but to unemployment, depression, and social upheaval. Great scientific efficiency is always a danger unless it can be accompanied by a corresponding rise in public understanding. Science and the gains of science must always be explained and sold to the multitude who are interested primarily in the loaves and fishes.

Which brings us to the last problem we shall mention and that is the lack of scientific salesmanship.

The Scientific Method

This ability to sell one's self and his profession to the public is one of the outstanding characteristics of the lawyer, and the inability to do it is one of the greatest weaknesses of the physicial scientists. We have the greatest thing in the world to sell—the scientific method—and we do it poorly even yet, though much better since Edwin Slosson.

The scientist clearly realizes that his material gifts from the larder of science are but loaves and fishes for the multitude, and that his greatest contribution is not any material thing but is instead an attitude of mind and a method of arriving at the truth. This scientific method has remade the physical world in three generations and produced for us that physical environment which we boastingly call "Modern Civilization."

This very same method, if universally adopted, would have as great an effect upon our spiritual life and morals as it has had on the material realm. Aristotle, the most prolific and influential of the Greek philosophers, gave us a method which has been called "The Aristotelian or Deductive System." Men followed it and gave the world the Dark Ages. It will always do it. Galileo falteringly pointed the way to a new method, but under the pain of death he recanted the faith that was in him. But as he left the trial chamber he whis-

pered to his friend, "Eppur si muove," (But still it moves.). Aristotle taught and all philosophers believed that heavy bodies fell more rapidly than light ones. "Let's try it," said Galileo. He accordingly placed on a board, on the top of the Leaning Tower of Pisa, balls of the same size made of different substances, such as wood and lead. A tip of the board dropped them all at the same moment. They struck, of course, at exactly the same time. Experiment and deductive theory here met in open contradiction. The philosophers knew their theory was correct. They continued to hold it. The experiment failed to convince. At that moment the inductive and deductive systems parted company. The multitudes followed the philosophers. But slowly through the centuries their following dwindled until the stand of a few religionists and politicians alone marks the old position.

Finally, Sir Francis Bacon, whom Pope called "the wisest man that ever lived," wrote his *Novum Organum,* and definitely introduced the scientific method. As long as men approach the solution of a problem with a preconceived notion and then search for and even distort facts in order to establish their preconception, just so long will we have racial jealousy, religious intolerance, and political animosity. Fortunately, for all, the scientific method is slowly gaining on the darkness.

It is reported that during his campaign, a religious fanatic asked Herbert Hoover his opinion on a certain debatable issue. Mr. Hoover replied, "I have no opinion. I never have an opinion on a matter unless I have had an opportunity to make a careful study of the facts." A perfect illustration of the scientific attitude of the mind. The intensity of the opinion of most politicians is inversely proportional to their knowledge of the facts.

Facts and Theory

Can any honest truth-searcher imagine that by placing facts first and theory second that mankind could possibly arrive at the "fifty-seven varieties" of foolish conclusions that make possible the division of Christianity into its warring camps? No! These are possible only because a definite belief handed down ready-made is accepted first, and then the Bible and human experience are searched for things that will substantiate this preconception—a typical deductive procedure. Is a man a Republican because an unprejudiced and open-minded study of the facts of government and economic policy has led him to this conclusion? Certainly not. As Ignatius Donnelly used to say, "My grandfather was a Democrat, my father was a Democrat, and by the grace of God I expect to die a Democrat."

Scientific discussions are never marked by the animosities which characterize those of religion and

politics. This is simply because the first question in a scientific discussion always is, "Just what now are the facts? What is it we really want to know?" From a background of such commonly accepted facts, no great variety of conclusions can logically be drawn. Jealousy, intolerance, and animosity are based on prejudice, never on fact. The universal acceptance of the scientific method would render them and the snobbery, feuds, and wars which they generate, alike impossible. Such is the Credo of the scientist. Such is his Evangelium. The greatest mission of the scientist is to sell the world on his method. His physical accomplishments are but "proof of the pudding." Unfortunately the public has accepted the material gifts of science much more rapidly than it has the method by which scientific truths are arrived at. "Ask me not what I believe. I have no beliefs, only tentative hypotheses. I am interested in facts."

1948 Rubber Consumption

John L. Collyer, president of the B. F. Goodrich Company, told stockholders on April 20th, that the consumption of rubber in the United States in 1948 is estimated to be about sixteen per cent below the figure for 1947, but forty-four per cent higher than in the peak prewar year of 1940. The expected consumption for this year is 940,000 tons, compared to 1,122,000 in 1947.

Welfare Services Sponsored by the A.I.C. During Depression Years

M. R. Bhagwat, F.A.I.C.

The Mathieson Chemical Corporation, Inc., Niagara Falls, N. Y.

(The author was secretary of the Chemists' Unemployment Committee and of the Chemist Advisory Council.)

I Chemists' Unemployment Committee

It was the winter of 1931. Unemployment among all types of skilled or unskilled, professional or non-professional people was widespread. A very large number of families in the New York greater metropolitan area were in dire need. Therefore, the New York Citizens' Committees, known as the Bliss and Gibson Committees, had raised funds through general voluntary contributions and established relief projects to assist those in distress who resided in New York. Several groups, such as musicians, actors, etc., had set up relief centers to provide food, clothing, lodging, and other immediate needs for the unemployed among their own ranks. A Professional Engineers Committee was organized by the Four Founder Engineering Societies and a large number of the unemployed civil, mechanical, electrical or mining engineers were helped through the city, state, and federal made-work relief projects.

However, the unemployed chemists and chemical engineers had no place of their own where they could receive sympathetic hearing and secure any available assistance to relieve their immediate needs. Realizing these conditions, a group of the unemployed and the employed in the chemical profession in the New York metropolitan area held several informal discussions. Finally on March 4, 1932, it was decided to establish the Chemists' Unemployment Committee (C. U. C.). The full name was Committee on Unemployment and Relief for Chemists and Chemical Engineers. The office was located at 300 Madison Avenue, New York City.

Objectives

The Committee began its work with the following objectives:

1. To maintain a registration file of unemployed chemists and chemical engineers, and to study their educational and experience records and personal problems.

2. To provide employment when-

ever possible and, in cases of distress, to give financial or other assistance required to maintain the morale of the registrant.

3. To secure assistance for needy registrants, either in the form of work or relief, from government and other welfare agencies established for emergency relief.

4. To bring to the attention of employed chemists and chemical engineers, technical societies, and the chemical industry in general, the difficulties confronting those unemployed in the profession and to secure their financial support in carrying out the above objectives.

Organization and Services

Immediately thereafter, THE AMERICAN INSTITUTE OF CHEMISTS, together with twelve other chemical associations and twenty-five leaders in the profession, sponsored the objectives of the Committee. A very effective finance committee was set up and funds were raised from voluntary contributions by those who were in a position to give. THE AMERICAN INSTITUTE OF CHEMISTS was one of the contributors to the initial funds needed to cover the expenses for the first letter of appeal by the Committee.

With the above as a start, the Committee rendered a timely and very much needed welfare service for six years. During this time, about 3,000 chemists and chemical engineers registered and were helped. Eighty per cent of this registration was from the greater New York area. It is estimated that 2,000 additional unemployed men and women with insufficient chemical training called on the Committee. These borderline cases were given advice and guidance so that they could find employment outside of the chemical fields.

It is needless to add that all the unemployed were in search of jobs. However, many of them needed immediate help. Those in distress were provided with food, clothing or lodging. About 500 were helped through the made-work relief projects of the city and federal emergency organizations, and 213 were assisted through a fundamental research program sponsored by the Committee with the co-operation of the universities. More than 1,200 experience records of the unemployed, covering practically all major branches of chemistry and chemical technology, were brought to the attention of the employers through the courtesy of the three leading technical publications. Wherever possible, the major objective was to locate suitable employment. However, every registrant required some specific type of immediate assistance based upon his individual circumstances. Therefore, the most important feature of the Committee's service was to maintain the morale of the unemployed and build up courage to over-ride the acute stages of economic difficulties.

Funds

As indicated above, the Committee's work was supported by voluntary contributions received in response to the appeal letters. During the six years of the Committee's existence, $52,358.57 was contributed by 1,071 individuals, 37 chemical companies, and 24 laboratory groups representing 224 persons. In addition to this, $2,625.00 was donated toward a special research fund and $979 for a special food fund.

It should be noted that members of the staff of the Committee, including those required for supervisory services, were selected from the unemployed registrants and they received nominal wages averaging $5.00 per day. Most of the general requirements, office space, furniture, etc., were donated. Therefore, all the contributions were used directly toward assisting the unemployed.

Further Plans

Here was the first welfare organization of chemists founded and supported by all branches of the chemical profession. Since it was an emergency venture, all human problems were dealt with on an emergency basis. It was generally felt that a permanent, national organization was needed to investigate and adjust the personnel and economic problems in the profession. Factual data and accurate information covering all important factors, which may cause unemployment or would lead to lowering the economic standard of chemists, must be collected and evaluated.

At several of their council meetings, THE AMERICAN INSTITUTE OF CHEMISTS discussed the various problems involved in continuation of the Committee on a permanent basis. During this period, more than 200 executives, educators, and philanthropists were personally interviewed by the Secretary of the Chemists' Unemployed Committee and all favored the plan of establishing a permanent, national organization. These discussions resulted in the formation of Chemist Advisory Council, Inc., on January 27, 1938.

II Chemist Advisory Council, Inc.

The Chemist Advisory Council was incorporated as a membership association under the laws of the State of New York by nine men who had actively sponsored and supported the welfare activities of the Chemists' Unemployment Committee. These men were widely known in the chemical profession for their outstanding leadership in their respective fields. The Council was formed with the objective "to promote the general welfare of chemists" in the United States, with the principal offices in New York. The incorporators elected a Board of Directors who were empowered to elect organizations or persons as members of the Advisory Council. Thereafter, on February,

24, 1938, the Board of Directors of the Council took over the entire files and funds of the Chemists' Unemployment Committee with the approval of the sponsors and major contributions of the Committee. Additional members were elected and officers, executive and finance committees were appointed. The new organization thereafter started registration of the unemployed chemists and chemical engineers and secured factual information covering important branches of the chemical industry and the chemical profession in general.

Registration

From February, 1938 to January, 1942 (when the Council suspended its work), more than 2,100 unemployed chemists and chemical engineers called on or corresponded with the Council for help. About fifty per cent of this registration was from the New York area and the remaining was made up of residents of forty-four states. Graduates and post-graduates of more than 175 colleges and universities were represented. Experience records of these registrants covered almost all major fields and positions.

Assistance

Registrants were helped in many ways. A large number required guidance in the preparation of experience records to bring out the most important features of their qualifications best suited to fill the prospective vacancies. Trends in employment were investigated and persons with varied experience were shown how to locate the industries which might have opportunities for them. Several of the unemployed were given suggestions in preparing for an interview with contacts already made. Occasionally a slight change in attitude was all that stood between the applicant and the job, Fitting men and women for available jobs and the location of these jobs by research, contact, correspondence, etc., stimulated interest among those seeking work and also in the industries.

Where courage and confidence were lacking, these had to be instilled. Sometimes excellent chemists proved to be highly sensitive introverts who developed a sense of inferiority because of unemployment. In these instances, morale had to be kept up. The Council was a place where the employed, unemployed, unsuitably employed, and the employer came to discuss their individual problems in confidence. In most instances, the results were satisfactory.

With the compliments of the respective publishers, the Council received a large number of technical publications, various types of information bulletins, and reference books for the use of the visitors. Several of these technical publications donated space in their "Positions Wanted" columns for the unemployed registered with the Council.

A card index containing general information on about 3,000 chemical and allied companies was compiled and available for the use of the unemployed registrants.

Finances

As in the case of the emergency Unemployment Committee, the Council was also supported by voluntary contributions. The Finance Committee planned to secure a permanent source of funds through endowments or combined contributions from the industry and technical associations. However, these plans did not receive effective support from the Board of Directors. Also, the sponsoring organizations and members did very little to assure sufficient funds to keep the organization going at least during the initial trial period between five to ten years.

During the four years of the Council's active life, $17,915.02 was collected through the generosity of more than 800 contributors. Other receipts, including the money left over in the treasury of the Chemists' Unemployment Committee, were $1,108.22. The Council, therefore, had merely about $4,700 per year to carry on its work. However, it is important to note that among the contributors were 21 companies, 4 technical societies and associations, and 21 chemical company laboratories representing 532 individuals. The total number of individual contributions from 1938 to 1942 was 1,354.

THE AMERICAN INSTITUTE OF CHEMISTS was one of the sponsors and contributed to the funds of the council.

At this point, it should be noted that the Board of Directors and members of the Council not only donated their services but also supported the organization by personal contributions.

Expansion Plan

The National Council of THE AMERICAN INSTITUTE OF CHEMISTS held many discussions on the activities of the Chemist Advisory Council. At all these meetings, the secretary of the Advisory Council was present as a guest of the INSTITUTE and kept the National Council informed regarding the services of the Advisory Council in helping the members of the chemical profession. During these discussions, it was also suggested that THE AMERICAN INSTITUTE OF CHEMISTS should take over the Advisory Council and carry on the objectives of the Council as a major program of the INSTITUTE on behalf of the profession.

Through the courtesy of the editor of THE CHEMIST, periodic reports covering the services of the Chemists' Unemployment Committee and Chemist Advisory Council were published in THE CHEMIST. Thus, the members of THE AMERICAN INSTITUTE OF CHEMISTS were kept informed of these welfare efforts on their behalf.

As the work of the Council con-

tinued, the number of calls for assistance from chemists and chemical engineers located at a distance from New York steadily increased. Therefore, during 1941, the president of Chemist Advisory Council, upon his own initiative, wrote to many of his acquaintances who were members of the chemical profession, inquiring if they would volunteer to establish branches of the Council in their respective areas. The response was almost unanimously favorable. This led to the organization of 62 sections of the Advisory Council. These sections were located in all the major industrial parts of the United States. At this stage, the Advisory Council had 38 elected members—a group consisting of leaders in major fields of the chemical profession.

While plans were being formulated to use the headquarters of the Council at 60 East 42nd Street, New York, as a central clearing house for the newly created sixty-two sections, the funds in the Council's treasury were running low. It became quite difficult to meet the very small expenses required to keep the office of the Council going. No new funds were in sight. The general conditions were changing because of the impending World War. The Board of Directors of the Advisory Council, therefore, decided to suspend the activities of the Council and the office was closed in January 1942. Office files, records, etc. were transferred to THE AMERICAN INSTITUTE OF CHEMISTS. The balance of funds in the Council's treasury were left in the bank under the custody of the Treasurer of the Chemist Advisory Council. The Corporation Minutes of the Advisory Council were also left with the Treasurer.

Thus ten years of continuous and effective welfare services to chemists during the depression were terminated, as World War II engulfed the United States.

Pyrometer Instrument Company Moves

The Pyrometer Instrument Company announces that its new plant, laboratory, and office were completed on March 15th. The new address of the company is now Bergenfield, New Jersey.

Married

Mary B. Latimer, A.A.I.C., informs us that she is now Mrs. Jay Merritt Mount. Mr. Mount spent four years overseas in the Corps of Army Engineers. They are living in Chevy Chase, Maryland.

Changes in Chemistry Teaching During the Past Twenty-five Years

Dr. Ralph K. Carleton, F.A.I.C.

Formerly of Rhode Island State College; now Associate Professor of Chemistry at Boston College, Chestnut Hill, Massachusetts.

TO one who has been closely associated with the educational field during the past quarter of a century, many changes in chemistry instruction have been apparent. On the other hand, however, some changes have come about of which one may be only faintly aware, since they have come about so gradually as to be scarcely recognized by the great proportion of chemistry instructors. Doubtless, most everyone will agree that progress in teaching a subject such as chemistry has been made, though there may not be general agreement as to the desirability of some of the changes that have taken place.

Let us examine the situation critically and note some of the contributing factors that have been responsible for these changes. The past seventy-five years have witnessed the establishment of practices and the extension of instruction until today, chemistry in some manner affects the lives of thousands of students in both high school and at a higher level. During the past quarter of a century, however, there have been notable contributions to the methods of educational investigation and study, and these have come in large part as a result of transfer of the method of work evolved by scientific workers in the fields of the biological and physical sciences to this field. A teacher of chemistry today has no patience with a philosophy or theory which has no factual foundation. More and more, the scientific approach has been used in facing the problems confronting the chemistry teacher.

Reference to the *Journal of the American Chemical Society* (Golden Jubilee Number, Aug. 20, 1926) published on the occasion of the fiftieth anniversary of the founding of the Society, indicates that twenty-five years ago people in the educational field were aware of the need for instruction in chemistry to prepare students specifically for vocational pursuits. In fact it appeared at that time that the major objectives of college education in chemistry were (1) the development of industrial and agricultural applications; (2) the development of research; (3) the general diffusion of the method and

attitude of mind of the scientist.

But as industry expanded, due directly to the first World War, and chemistry became more and more a factor in agriculture, it became evident that specific courses in chemistry were needed to meet the needs of various groups of students. Up to that time it was thought that practically the same chemistry course was sufficient for all. However, many were beginning to raise the question whether the course that is best for vocational training is also best for liberal training. There was need then of a proper differentiation of courses to meet the needs of various vocational groups. There was, for example, an evident feeling of doubt that the course in chemistry then given for dentists, was for them either vocational or cultural in the best sense. The vocational values of chemistry for dentists (or for medical students, nurses, or civil engineers) were not carefully defined. As these problems have been studied through the years, an economy of time on the part of the student and financial economy in the colleges has been the result.

During the quarter of a century that has elapsed, these problems have been worked through and the chemistry curricula have been critically examined. Specific courses designed for definite divisions of chemistry have come into being. The four fundamental fields, Introductory, Analytical, Organic, and Physical still remain, but there has developed a multitude of specific courses, usually of a semester's length, designed to give training in a particular subject or some branch of that subject. Let us examine briefly some of the changes that have come about in each of these so-called "fundamental fields" of chemistry.

Introductory Chemistry

In introductory chemistry it appears quite obvious that the trend has been definitely away from the historical, factual, descriptive introduction and an insistence on atomic structure and modern concepts of acid and bases and even pH to provide a foundation before the students have a thorough knowledge of the properties of common chemicals. What really has happened has been the projection of physical chemistry into the introductory course before the average student can grasp the ideas. This has caused the teaching of chemical topics in high school that twenty-five years ago were not touched upon until one was in college. The merits of that situation will be passed over without comment in this paper.

Analytical Chemistry

In analytical chemistry, it appears that more and more emphasis has been placed upon theoretical principles to the exclusion of practical laboratory analysis. The excuse offered is that "so much time is required" and "after all this isn't what the student will

probably do when he goes to get a job." In fact, there has been consideration given, at a prominent university, to eliminating the course in qualitative analysis altogether and substituting perhaps a course in advanced inorganic chemistry. Qualitative analysis is looked upon by some as merely a preparation for physical chemistry. In quantitative analysis, too, there seems to be a strong tendency to bring instrumental methods into the elementary course and thus limit the amount of volumetric and gravimetric experience for the student. There seems also to be a tendency to supplant the standard volumetric and gravimetric methods by colorimetric methods, without due consideration of the training of the prospective chemist in giving him a sense of proportion in the evaluation of different methods. On the other hand, there has been a vast improvement in textbook presentation of volumetric procedures and the incorporation of new concepts such as 'Redox', internal indicators, and adsorption indicators. If there is a deficiency in the teaching of analytical chemistry it lies in a lack of the teaching of principles and practical applications of precision.

Organic Chemistry

During the years, the accumulation of a tremendous amount of new material, resulting from the discovery and synthesis of new organic compounds and their derivatives, has made organic chemistry probably the best organized subject in the curriculum. The incorporation of a knowledge of atomic structure has proceeded moderately, although the organic chemistry teacher has not been reluctant to use electronic explanations of organic reactions, as preparation for advanced courses, in the field.

Physical Chemistry

Physical chemistry used to be looked upon as somewhat of a hodgepodge of chemistry, physics, and mathematics. Through the years it has progressed into a more systematic subject, with rather definite ground to be covered in a beginning course and with a solid foundation on thermodynamics. The division of material to be studied is rather definitely followed in applying the subject to more advanced courses. Physical chemistry has really come into its own within the past twenty-five years.

Graduate Study

While these changes have been going on in the undergraduate field, the importance of graduate study in chemistry has been continually emphasized. It used to be that when one had gone through college and had completed studies in the four fundamental fields mentioned previously, one could be graduated as a chemist and go out and secure a position in a chemical plant. Not so these days. At the end of the Freshman year, an undergraduate may be thinking about what graduate school he would like to

attend in order to secure a Master's degree. He does not wait until he is near graduation or until it is suggested to him by an interested professor that the financial returns are likely to be considerably increased, if he pursues graduate studies to the Master's degree, at least. It appears, among the majority of students nearing the completion of their undergraduate training in chemistry, a foregone conclusion that some graduate study is necessary. And, of course, that is pretty largely true. It can scarcely be contradicted that the greater proportion of industrial laboratories are more interested in applicants for positions who can present evidence of having carried on some graduate study than in a young person who has just graduated from college with a bachelor's degree. This, no doubt, is as it should be, but the point I wish to emphasize is that the matter of graduate study is taken much more for granted than was the case a quarter of a century ago.

Fellowships

Research Institutes of the calibre of Mellon Institute, Battelle Memorial Institute, and the like, have come into prominence in the last twenty-five years or thereabouts. These organizations have had a profound influence upon chemistry teaching throughout colleges and universities. Fellowships providing for work at these institutions have served as definite objectives for scores of young men who wanted to continue graduate study. It was not so many years ago that one of the fellowships financed by industry, about which one used to hear a good deal, was the DuPont Fellowship supported at a number of educational institutions over the country. Now, that is only one of a large number that are made available by various industries at many institutions throughout the land. Undergraduates have had the opportunity to observe increasing numbers of graduate students at work on projects made possible through fellowships which have constantly increased in money value. All these new features, which were rather "scarce articles" twenty-five years ago, have served as an incentive to graduate study. This has changed considerably the emphasis that used to be placed on the objectives of chemistry teaching.

In conclusion, may I express sincere thanks to Albert F. McGuinn, S.J., chairman of the chemistry department of Boston College, for helpful suggestions in the preparation of this article. Thanks also to Prof. J. W. Ince, F.A.I.C., chairman of the chemistry department of Rhode Island State College for his comments, and to Dr. Raymond E. Kirk, F.A.I.C., dean, Graduate School, Polytechnic Institute of Brooklyn, for his assistance.

Chemical Prices in 1923 and 1948

Dr. Frederick A. Hessel, F.A.I.C.

Treasurer, A. I. C.

IN connection with the twenty-fifth anniversary of THE AMERICAN INSTITUTE OF CHEMISTS, it may be of interest to see what has happened to the price structure in the chemical field during these years.

Theoretically, it was expected that chemical prices would show fluctuations different from those in the general price index. The substitution of synthetics for natural products would seem to keep the chemical industry, insofar as it is not dependent on other industries, free from the over-all price rises which have characterized the last quarter of a century.

To test this reasoning, a comparative table was prepared, which consists of various classes of chemical raw materials and their prices, taken from *The Oil Paint and Drug Reporter* for January 1, 1923, and the same date in 1948. Natural products, petroleum, heavy chemicals, and organic chemicals were selected as the classes of materials which would reveal the picture of the industry.

Products in the first class, whether animal or vegetable, depend more or less on the general price index. They are, therefore, substantially higher in price today than they were twenty-five years ago. Sardine oil, for example, costs 22 cents a pound now, as compared to 49 cents a gallon in 1923; peanut oil 29, as compared to 12 cents per pound; corn oil 32, as compared to less than 10 cents a pound; cottonseed 28, as compared to a little over 9 cents a pound; soya oil 27, as compared to less than 10 cents a pound, and stearic acid 34, as compared to 11 cents a pound.

Exceptions in this group are naval stores, which cost today either less or only a little bit more than in 1923. Wood turpentine, for instance, is 65 cents a gallon now as compared to \$1.40 then; and rosin is a little over 9 cents a pound as compared to 8 cents in 1923. Another exception is furfural, which is 9½ cents a pound as compared to 25 cents in 1923. Many new uses were found for this by-product of agriculture and consequently larger quantities of it were produced.

Petroleum products have shown little change in price during the period under consideration. Most of them cost a little less or just the same now as in 1923. Kerosene has gone down from 15 to 9 cents a

gallon; V.M.P. naphtha from 21 to 14 cents, while petrolatum (Snow White) dropped from 11¾ cents per pound to 7¼ cents. Petrolatum (Amber) is unchanged at 4¼ cents a pound.

Heavy chemicals, too, have varied very little in price, as may be seen from the following list:

	1923	1948
Lithopone	$ .065	$ .06 per lb.
Aluminum sulphate	2.67	2.10 per lb.
Salammoniac (gray)	.085	.07 per lb.
Carbon tetrachloride	.1025	.11 per lb.
Soda Ash (light) 58%	1.92	1.30 per 100 lb.
Sodium bicarbonate	1.75	1.85 per 100 lb.
Soda caustic (76%)	3.67	2.85 per 100 lb.
Muriatic acid (22°)	1.87	2.42 per 100 lb.
Nitric acid (42°)	7.75	6.75 per 100 lb.
Sulphuric acid (66°)	15.00	15.00 per ton

On the contrary, organic products which have been made synthetically are nearly all materially lower in price than their natural counterparts, particularly those which are now produced in much larger volume. Typical of this class are:

	1923		1948
Acetone	$ .21		$ .08 per lb.
Methyl alcohol	1.28	synthetic-	.35 per gal.
		natural-	.60
Formaldehyde	.1625		.0375 per lb.
Acetic anhydride	.385		.145 per lb.
Phenol	.375		.125 per lb.
Phthalic anhydride	.41		.175 per lb.

It is generally correct, therefore, to assume that where the chemical industry is not dependent on raw materials used in other industries, its products have not followed the general price trend. Chemicals maintain an even level when other products fluctuate, except that when chemicals are produced in larger volume or synthetically, their price is reduced, even when the general price trend of the period is sharply upward.

A Quarter-Century of Chemistry in the South East

Dr. Stewart J. Lloyd, F.A.I.C.

Dean, Professor of Chemistry, University of Alabama, University, Alabama

A BOOM, a bust, and a great war have all happened in the last quarter century. Through all three the chemical industry has grown in the South East. In 1923, there were no rubber plants here, now there are three. There were no phenol, alumina, aluminum sulfate, ammonia plants, and few paper mills, or oil refineries. Fertilizers, chamber sulfuric acid, coke oven byproducts and naval stores made up the list of our chemical industries.

In 1923, facilities for training chemists were few and poor in the South East, and the terms chemist, analyst, and pharmacist were nearly synonymous. The writer when he told a new acquaintance, at that time, that he was a chemist was complimented on his useful job of running a drug store. The two world wars and the atomic bomb have brought the subject of chemistry and the work of the chemist into every little hamlet and cross roads of the South.

Little chemical research was going on in the South in 1923. Today we have the Southern Research Institute at Birmingham (modeled on the lines of Mellon Institute), the Textile Institute at Charlottesville, and several other research institutes attached to universities and colleges, at Atlanta, Chattanooga, and elsewhere.

Departments and schools of chemistry in the southern universities have likewise grown, with an increasing number of graduate students. One great need, however, is an increase in the number of institutions granting the Ph. D. in chemistry, and a strengthening of the work of those now doing so.

There has not been until lately much class consciousness among chemists anywhere, and this has been particularly true in the south. This is due, in the opinion of many, to the lack of professional standards, and to the practice adopted by many chemistry teachers of advising all comers to make chemistry a profession.One of the greatest services that can be performed by an instructor is to keep people out of the chemical profession who ought not to be there.

The South East is not a fertile country save in some favored spots, but at growing trees it is a world-

beater! Pine and oak, gum, and poplar grow freely and rapidly whether you want them or not. Trees are a renewable crop, unlike coal, oil, natural gas, and minerals in general. The future chemical industry of the South East will center around trees, around cellulose, lignin, tallol, turpentine, rosin, the wood sugars, and so on. One newsprint mill is now running, another is on the way, while sulfate mills abound. To the graduating chemist in the South East we say, "Hitch your wagon to a tree, not to a star."

Alpha Chi Sigma Meeting

The Professional Chapter of the Alpha Chi Sigma met April seventh at the Hayden Planetarium, New York, N. Y., featuring a Sky Show prepared for chemists on the subject, "The Chemist Looks at the Sky." The lecture was given by Shirley I. Gale, chemist at Calco Chemical Division of American Cyanamid Company, and a number of the Planetarium lecturing staff.

Safety Award to Heyden

The Heyden Chemical Corporation plant in Fords, N. J., received a Merit Award in the Interplant Safety Contest sponsored by the New Jersey Department of Labor and the New Jersey Industrial Safety Committee, for its safety record of 440, 000 man-hours without a lost-time accident.

The Construction Specifications Institute

A new organization dedicated to the improvement of specification writing and practices in the construction and allied industries has been formed, to be known as The Construction Specifications Institute, Inc., with headquarters at 1825 K Street, N. W., Washington 6, D. C. Officers are James B. Moore, chief of Specification Review Unit, Division of Hospital Facilities, U. S. Public Health Service, president; Carl J. Ebert, head of Architectural Specification Section, Bureau of Yards and Docks, Navy Department, vice president; and Francis A. Updegraff, architectural engineer, Construction Division, Veterans Administration, secretary-treasurer.

Dr. Joseph Mattiello, F.A.I.C., spoke on "Protective Coatings as Engineering Materials" before the Rensselaer Society of Engineers, April fourth. This group is a student organization connected with Rensselaer Polytechnic Institute, Troy, N. Y. The talk was illustrated by lantern slides and a sound film, showing the method of manufacture of paints and varnish products in Switzerland.

Lawrence H. Flett, F.A.I.C., has been elected vice president and chairman of the project's committee of the Commercial Chemical Development Association.

Progress in Biochemistry During the Last Quarter of a Century

Dr. Edward A. Doisy, F.A.I.C.

Nobel Prize Winner

(From the Department of Biological Chemistry, St. Louis University School of Medicine, St. Louis, Missouri).

AT times one may become discouraged because progress in the solution of some problems seems so slow. At such times it is a source of comfort and encouragement to review briefly the wonderful accomplishments of the past, to recall the problems which a quarter of a century ago were so perplexing yet have yielded to persistent investigation. It is, therefore, a privilege to have the opportunity of discussing briefly some of the more important contributions of biochemistry during the last twenty-five years.

Following the discovery of biological tests and the development of specific bioassay procedures, chemists working with their biological associates have isolated and identified most of the recognized hormones produced by ductless glands. Chemically the hormones are of two general classes: steroids or proteins. The protein hormones, insulin, gonadotrophins, corticotrophin, lactogenic, and growth have been isolated in pure form. The sex hormones and adrenal cortical hormones are steroids; several of these have been synthesized and in the case of the female sex hormone, estrogenic compounds, very different from steroids in structure, have been synthesized. Interest in the structure of the natural sex hormones, coupled with interest in Vitamin D, bile acids and cardiac aglucones has led to an amazing development in sterol chemistry.

Although three or four vitamins had been recognized by 1923 by the biological effects of their deficiency in the diet, their chemical constitution was still unknown. During the last quarter of a century more than a dozen vitamins have been obtained in pure form, their structures determined and the synthetic counterpart produced. Interest in certain chemical structures, such as, the thiazoles, alloxazines, pterins and condensed imidazole thiophene rings has been greatly stimulated by the identification of these groups in certain of the vitamins.

Amino Acids

Discovery and isolation of two new amino acids, methionine and theronine, paved the way for a study of their nutritive importance. The quantitative requirements of essential

amino acids in growing rats and chicks have been determined and considerable progress has been made in the extension of such data to the requirements of man. Evidence for definite interrelationships between vitamins and amino acids is accumulating. The importance of trace elements has been realized by the demonstration of the role of copper in hemoglobin synthesis.

Antivitamins

More recently the widespread occurrence and importance of antivitamins and antimetabolites have been realized and investigated. This work has been stimulated in no small way by the re-evaluation of the dye, prontosil, a part of which was found to be strongly bacteriostatic. The original observation of the bacteriostatic properties of the sulfa drugs, largely empirical, was later demonstrated to be due to a mechanism which is now known as a competitive reaction in an enzyme system, the natural, vital substance being a vitamin of the B complex, p-aminobenzoic acid.

Antibiotics

Other phases of antibiosis have been extensively studied. The efforts of many research groups in this country and England brought to the medical profession a new agent, penicillin, which is extremely efficacious in the treatment of many types of infectious disease. Complementary to this antibiotic which is effective mainly against Gram positive bacteria is another antibiotic, streptomycin, which is effective against Gram negative organisms. The importance of these two antibiotics has led to an examination of other molds, bacteria, yeast, fungi, vegetables, etc. for other antibacterial products.

Enzymes

During the last twenty-five years, enzyme chemistry has undergone remarkable developments. Beginning with the preparation of the first crystalline enzyme, urease, in 1926, several more enzymes have been obtained in crystalline form. Although these enzymes are proteins, their isolation as crystalline compounds has removed them from the realm of the mysterious and placed them, even though endowed with specific activities, alongside other crystalline proteins. Perhaps one of the most interesting enzymes recently obtained in crystalline form is phosphorylase, the enzyme which plays a role in the synthesis of glycogen from monosaccharide.

Viruses

Although the filterable nature of a virus (an infectious agent) was discovered almost half a century ago, chemical work on viruses has produced significant results for only a little more than a decade. In 1935 the infectious agent of tobacco mosaic virus was obtained in crystalline form. In contrast to bacteria, here was a crystalline material which could be recrystallized and yet under ap-

propriate conditions produce disease.

Chemical examination of several pure viruses has shown that they are nucleoproteins of high molecular weight. They have been split into the component nucleic acid and protein. A number of the amino acids customarily found in protein have been isolated from the hydrolytic products of the virus protein. Hydrolysis of the nucleic acid has given the purine and pyrimidine bases found in yeast nucleic acid.

Nucleic acid in combination with protein is also found in genes. Geneticists working with biochemists have shown that mutation of genes may cause an alteration of biochemical processes. Extension of this work revealed that the synthesis of an amino acid or a vitamin may be blocked by a change in genetic composition.

Isotopes

Perhaps one of the most interesting and useful tools supplied to the biochemist is the isotope. The chemist has been able to concentrate the stable isotope, while the physicist has perfected the nuclear pile to produce in large quantity the radioactive sister elements that were not so readily prepared by the cyclotron. The physicist has perfected the mass spectrometer and the Geiger counter for the measurement of stable and radioactive isotopes, respectively, so that the biochemist may now select from the isotopes of carbon, hydrogen, iodine, nitrogen, phosphorus, sulfur, iron, and oxygen, those useful for a renewed attack on some of the older problems that have defied solution to this day. For example, the precursors of creatine were, at least in part, suspected but the tagging of the amidine group of arginine and the amino group of glycine with N15 and the methyl group of methionine with deuterium gave convincing evidence of the participation of these three amino acids in the *in vivo* synthesis of creatine.

Instruments

The creation and perfection of the respirometer by Barcroft, Warburg and others made possible to a large degree the study of microbial respiration, tissue metabolism and other phases of enzyme systems, both aerobic and anaerobic respiration being studied. Thus the determination of the respiratory quotient for various tissues was facilitated, and, following the discovery of Warburg's "yellow enzyme" a host of other intracellular enzymes has been announced. Dehydrogenases, oxidases, and catalases have been intensively studied, with the recognition of specific enzymes and enzyme systems. Coincidently, a greater knowledge of the relations of vitamins to enzyme systems and tissue metabolism was realized.

Other instruments of particular value to the biochemist are the ultraviolet and infrared spectrophoto-

meters. The development of the science of spectroscopy and the availability of excellent instruments at a price within the reach of most laboratories are making it possible for the biochemist to "fingerprint" organic compounds in a way never before possible. The ultra centrifuge and the electrophoresis apparatus and the x-ray and electron diffraction cameras have similarly aided in obtaining dimensions for the largest of molecules, the proteins.

The development of these forms of apparatus has been of real assistance in the study of viruses and proteins. In this connection the fractionation of plasma proteins on a large scale, providing albumin, fibrinogen, prothrombin, and immune globulin is important.

For his every day needs the biochemist relies heavily on his pH meter, electrometric titrimeter, and his photoelectric colorimeter. The latter instrument is an outgrowth of the old visual colorimeter that has found such extended use in carrying out the number of micro analyses that the modern biochemical laboratory is asked to perform.

Tests Evolved

Countless tests for estimating the efficiency of organs, systems, and body reactions have been designed and discovered by the biochemist. Means by which an estimation of the extent of bodily damage inflicted by trauma or disease process have been described. Many problems puzzling the physician and biochemist twenty-five years ago have been elucidated by workers in the field of biochemistry. The questions clarified or solved are too numerous to mention, but, as examples, one might consider the liver and kidney function tests, the various tolerance tests, the role of vitamins and hormones in the etiology of disease and in replacement therapy, and the biochemical tests designed to differentiate between similar clinical syndromes and in many instances their widely varied etiologies. The biochemist has aided not only the diagnostician, but also the surgeon in pointing the way to proper pre- and post-operative electrolyte therapy.

The various fields of medicine during the last quarter century have been extended and enlarged surprisingly by the biochemist and by men of widely diversified training and calling who have utilized biochemical techniques. As the science of biochemistry develops and expands, it becomes increasingly difficult to classify the individual scientist; are not the microbiologist, the physiologist, the organic, inorganic, analytical, and physical chemist, the biophysicist, the nutritionist, and a host of others—are they not, when studying living organisms, reactions, and systems, "biochemists"?

Chemists' Contributions to Cosmetics 1923–1948

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THE Tut-Ank-Amen figure — slim, slender and graceful — was the vogue back in 1923. All a lady had to do to achieve this silhouette was to pat on "reducing" cream, which, according to advertising claims, "literally melted unwanted fat away." Face packs and beauty clays were popular, and lipsticks were beginning to come into general usage. Cosmetics recommended for a lady's week-end kit were a book of powder leaves, a tube of cold cream, and a small can of talc. Actresses wrote testimonials that "cosmetics haven't harmed me" and manufacturers were advertising that their face powders did not contain white lead.

By 1938, cold creams had grown into a fantastic assortment of "nourishing," "rejuvenating," "skin food," and "wrinkle remover" creams, when Congress passed the Federal Food, Drug and Cosmetic Act. Dangerous, adulterated, and misbranded cosmetics were no longer tolerated, and cosmetics (except hair dyes) had to contain only those coal-tar colors which came from a batch certified as being harmless. Under the Act "the term 'cosmetic' means (1) articles intended to be rubbed, poured, sprinkled, or sprayed on, introduced into, or otherwise applied to the human body or any part thereof for cleansing, beautifying, promoting attractiveness, or altering the appearance, and (2) articles intended for use as a component of any such articles; except that such term shall not include soap." Tooth paste, shaving cream, shampoos and other products containing soap are cosmetics and are subject to the consumer-protective requirements of the law.

The chemists' contributions in the field of cosmetics might be considered as falling into two broad groups: (1) development of basic raw materials by the chemical industry, and (2) adaptation of these materials by the cosmetic industry in the improvement of old products and formulation of new ones.

Among the contributions of chemists have been increased purity, uniformity, and stability of raw materials; surface active agents, such as emulsifiers and detergents; synthetic oils and waxes; polyols; higher al-

cohols; amines; processed lanolins; coal-tar colors; anti-oxidants; and synthetic aromatic compounds.

The cosmetic chemist selects and combines raw materials in such proportions that the desired esthetic and functional effects of the products are achieved. Important materials are emulsifiers which function by intermingling oil and water phases to form uniform, stable emulsions of any desired texture and consistency. Thus, cosmetic elegance can be obtained in creams and lotions when their grease-like ingredients appear as smooth, white, uniform emulsions. Even emulsions which appear as clear, transparent solutions are within the chemist's province. The wide variety of emulsifiers available today, ranging from the anionic types (such as amine soaps and fatty alcohol sulfates) to the non-ionic types (such as fatty acid esters of polyhydric alcohols and polyoxyethylene derivatives), has resulted in cosmetics with properties not possible with the traditional beeswax-borax emulsion system of twenty-five years ago.

When triethanolamine became available commercially in 1931, the cosmetic industry was quick to take advantage of the mild alkalinity of the amine soaps which are virtually non-irritating to the skin and stable on long storage. Brushless shaving creams, hand lotions, shampoos, and mascaras are products in which amine soaps are widely used.

New Emulsifiers

The non-ionic emulsifiers are a comparatively recent development which freed the industry from dependence on soap in one form or another as the standard emulsifier for cosmetics. The new emulsifiers have the advantage of being neutral and generally non-toxic. Also, they can form emulsions stable to freezing and to astringent salts, and are versatile because of the many combinations of the oil and water soluble types. Antiperspirant creams, containing aluminum chlorhydroxide, are virtually non-irritating to the skin and have no effect on clothing, as contrasted with the old-type liquids containing aluminum chloride.

Large amounts of pigments can be dispersed in creams made with these emulsifiers without breaking the emulsion as happens with ordinary vanishing creams. Pigmented powder creams and cream rouge are in this class. Colognes, toilet waters, and after-shave lotions of low alcoholic content may be prepared with non-ionic emulsifiers which solubilize the perfume oils, act as fixatives and form clear emulsions with water. Cream colognes, with or without alcohol, can be made with these emulsifiers.

Synthetic Detergents

Synthetic detergents, an important development of the chemical industry, have found wide acceptance in the cosmetic industry. Detergents of the following types have been found use-

ful in cosmetics: fatty alcohol sulfate, fatty alcohol sulfoacetate, sulfated fatty acid ester of polyhydric alcohol and alkyl aryl sulfonate. Soapless shampoos first appeared on the market in 1934. Their big advantage over soap was that they eliminated dulling film caused by lime soaps and left the hair with its natural luster. The cream-type shampoo, with lanolin or oil added to overcome the de-fatting effect of the detergent, leaving the hair soft and easy to manage, is a recent development. Detergents have made possible hair dye and wave preparations with special wetting and leveling properties, and also bubble bath products with high foaming and dispersing properties. Because of the compatibility of detergents with calcium and magnesium ions they are also being used in dentrifices containing high concentrations of these ions without loss of effectiveness or efficiency of the detergent. Such dentrifices can be made neutral or even slightly acidic, and less irritating to the gums than alkaline dentrifices containing soap.

Synthetic Waxes

Many other synthetic compounds having unusual properties are available to the cosmetic chemist. Synthetic waxes of high molecular weight (such as polyethylene glycols), may have the consistency of low-melting petrolatum or they may be solids of beeswax consistency, yet dissolve in water. Synthetic oils, having a wide range of viscosities, are available in water-soluble and water-insoluble types, which do not become rancid. Propylene glycol and sorbitol are useful as conditioning agents in creams and lotions. Cetyl and stearyl alcohols are employed as emulsifying assistants and render the skin smooth and "velvety." Carboxymethylcellulose, a water-soluble gum, is useful as a thickener and stabilizer in cosmetic preparations.

Lanolin

Lanolin has a unique combination of properties which make its use in cosmetics highly desirable. Through refinement, its color and characteristic odor have been greatly improved. Absorption bases, containing free and combined cholesterols and esters of lanolin, are odorless, less tacky than lanolin, and produce white creams. Work on the various processed lanolins, including both water-dispersible and water-soluble types, is very recent. These materials have indicated application as emulsifiers and as means of introducing lanolin to oil-in-water type emulsions where regular lanolin would affect the emulsifier balance. As lanolin is an effective skin-softening agent and is more nearly related to the oil secreted by the skin than any other commercially available material, it is used in such cosmetic products as all-purpose, emollient and cleansing creams; hand and suntan lotions; lipsticks; permanent-wave solutions, and hair-dressing preparations.

Hair Waving

One of the fastest growing items in the cosmetic industry today is the home permanent wave set, and the universal custom of bobbed hair paved the way for its widespread acceptance. Permanent waving was still in its infancy in 1923; by 1932 machineless waving came into use, followed by the introduction of cold waving in 1941. The active ingredient in cold wave lotions is ammonium thioglycolate which, by the action of mercaptan sulfur, softens the hair and permits change in form. Hair is set in the new form by use of an oxidizing agent or other fixative. Closely related to this development are odorless depilatories, the effectiveness of which is dependent on the action of mercaptans. (Depilatory action takes place around a pH of 12, while a pH range of 9.2-9.5 is necessary for cold waving.) Odorless depilatories containing calcium thioglycolate have almost entirely replaced the malodorous sulfide type.

Hair Dyeing

Woman's desire to change the color of her hair is motivated by social, economic, and esthetic reasons, and many a man judges her age by the appearance of her hair! Popular types of hair coloring agents were introduced about twenty-five years ago and modified by the advent of the oil-shampoo tint in 1930-31. This simplified hair-dyeing technique by combining three separate steps in the course of one application. Shampoo tints contain from 0.2 to 5 per cent of aromatic organic intermediates (depending on the color desired), in a base composed of 12 per cent ammonia soap and alcohol. They are free of metallic salts. The color is produced by the oxidation of the intermediates inside the hair with peroxide to higher molecular compounds which are deposited in the hair cortex as insoluble pigments. Hair dyes containing certain coal-tar derivatives must be given preliminary patch tests.

Lipsticks

Color plays an important role in cosmetics today, and stylish shades of lipstick, nail polish, and powder make-ups follow fashion trends. The "new look" has revived the feminine charm of the old-fashioned girl and demands that make-ups be of "pretty pink" shades. The modern women is skillful in applying cosmetics and carefully avoids the "painted-doll" look of many years ago, when lipsticks were non-indelible and face powder on application appeared white. Back in 1923, women were timid about wearing obvious make-up. Lipsticks were colored with pigments and oil-soluble colors which had little or no staining effect on the tissues and were quite artificial in appearance. The chemist helped popularize lipsticks by coming forth with an indelible "natural" lipstick composed entirely of a color, eosin (bromo acid), which stained the lips without being easily detectable as

added color. Lipsticks were improved by the adoption of carnauba wax or beeswax-castor oil body and the development of various bromo-acids for permanent staining qualities. When fashion called for brighter effects, pigmented shades became popular.

Nail Polish

The color theme of high-style nail polish today marks a vast improvement over the colorless or slightly tinted polish first introduced in the early 1920's. At that time, nitrocellulose lacquer nail polishes were clear and coloring was accompished by the use of dyes dissolved in the solvents. Creamy, opaque nail polishes represented a radical change from the transparent type and were made by grinding pigment colors and titanium dioxide into the lacquer. Improvements in lacquers have resulted in polishes of higher luster, greater wear, and freedom from tendency to produce skin irritation.

Powders

Simplification of face powder formulas has resulted from better understanding of qualities required in a face powder, such as adherence, smooth application, good covering power, and lack of shine. Thus a great many materials traditionally used but not contributing to these qualities were eliminated. Face powders have been improved primarily by the increase in pigment content; also by better grade talcs and zinc oxide, improved metal stearates, and purified titanium dioxide low in lead. By properly grinding face powder ingredients and dispersing color, the final product is improved and particle size reduced. About ten years ago, there was a revival of cake-rouge and cake-powder compacts in the form of cake make-ups. Then followed a variety of pigmented powder creams, liquid powders, and cream cake make-ups. These make-ups on application result in a pastel complexion which appears flawless, and titanium dioxide, whitest and most opaque of all pigments, provides the hiding power necessary to give a "mat" finish to the skin.

Perfumes

Perfumes are not only important in themselves but also enter into the preparation of cosmetics. The elegance of a cosmetic is largely achieved by the appeal of its perfume. The choice of perfume is, therefore, important and depends on the type of product to be perfumed. However, the perfume should not be positive or definite in its note, but should have wide appeal. Perfumes can be created from well over a thousand synthetic aromatic compounds which the organic chemist has developed. In addition, a whole family of fixatives has been synthesized, of which synthetic musk is outstanding. The use of synthetic aromatics greatly reduces the cost of perfumes and makes possible the creation of entirely new

types. An experienced perfumer knows that certain combinations of aromatics will produce certain "notes" in a perfume and that other aromatics should be avoided because of irritating properties or because sensitivity to them has been encountered. Finished perfumes are a blend of synthetic and natural oils and should be of uniform quality and not cause discoloration of cosmetics.

Protective Coverings

During the war, cosmetic and chemical manufacturers assisted in the development and production of skin protective preparations for use by the U. S. Army; namely, "paint, face, camouflage," insect repellents, flash-burn protection, antichap lipsticks, and sunburn protection. In war plants, the incidence of industrial dermatitis was reduced because chemists improved existing products through the formulation of bland yet effective skin cleansers and neutral, non-irritating protective creams, all cosmetically acceptable.

In order to meet the technical problems arising from materials shortages during the war, the Toilet Goods Association organized a Scientific Section. A leading cosmetic manufacturer has said, "Probably one of the greatest achievements of our chemists was their ability during the war to come forth with substitutes for materials that became unavailable, and thus keep producing our products without lowering their quality, or if this was absolutely impossible (as in the case of perfumes and a few other cases) to lower the quality very little."

Special Creams

Mention should also be made of "vitaminized" creams and hormone creams. It has been claimed that these creams improve the texture of the skin. By a government ruling, claims for "vitaminized" creams may not go beyond those for creams containing no vitamins and so they have disappeared from the market. Hormone creams have been the subject of much controversy, but nevertheless have established a definite place on the market. However, some in the industry believe that the value of hormone creams has not been proved. During the past ten years, the Federal Trade Commission has become increasingly active in curbing false or exaggerated advertising claims.

Number of Cosmetic Chemists

Most leaders in the cosmetic industry have become research-conscious and the larger companies have well-equipped laboratories, staffed by trained chemists. The number of companies with research laboratories devoted in whole or in part to work in cosmetics and related subjects was 74 in 1946, compared with 47 in 1940, according to data reported by the National Research Council. Cosmetic research workers in 1946 totaled 541, of which 235 were chemists and 62 of other professions. On

the basis of an estimated expenditure of $6,000 per worker, the cosmetic industry spent $3,250,000 on research in 1946. This represents less than ½ of 1 per cent of estimated sales of $700,000,000 in 1946 and is only a small fraction of what the industry spends on advertising! In computing the number of cosmetic research workers, it was necessary to eliminate those companies devoting only a minor portion of their total work to cosmetics. Research staffs were included only for those companies in which cosmetics constituted the principal, or an important, objective of research. The data, while not exact, serve to show the trend.

Future Trends

Future trends in cosmetics research will take place in several directions. In general, simplification of formulas should result as continued research yields an evaluation of various ingredients. New cosmetics will be developed from the ever-increasing supply of chemical raw materials, and these products will be more thoroughly tested, both chemically and biologically, than generally has been the case in the past. The over-all research objective in the cosmetic industry is to make better and safer products at no increase in cost. Also, research effort is being expended to improve the packaging of cosmetics and thus increase their salability.

In order to make cosmetics safer, the industry has under way long-term projects involving the development of methods for the evaluation of various substances to be used in cosmetics in terms of their sensitization or irritation when applied to the skin. A broader understanding of the functions of the skin is being sought by cosmetic companies making special studies of skin respiration. In addition, the newly formed Committee of Cosmetics of the American Medical Association is accumulating a complete file of information on the composition of cosmetics directly from manufacturers, as the medical profession desires to know the possible toxic properties of the products.

Symposium on Numerical Methods of Analysis

Illinois Institute of Technology is sponsoring a symposium on numerical methods of analysis in engineering, May seventh, on the campus in Chicago. Dr. Hardy Cross, head of the department of civil engineering, Yale University, was the main speaker. The occasion recognizes the twenty-fifth anniversary of the first concept of moment distribution by relaxation of restraints, a procedure originated by Dr. Cross.

Dr. Peter M. Bernays, assistant professor of chemistry at Illinois Institute of Technology has been awarded the $4,000, Frederick Gardner Cottrell grant by the Research Corporation of New York, for a one-year study of the chemistry of scandium.

Advancements in the Chemical Utilization of Fatty Acids

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A BROADENED concept is a necessary element of true advancement. The past twenty-five years are epochal in the fatty acid field, not because of the many important contributions which have been made to our knowledge of these substances but because within this period their inherent value as synthetic agents has, at last, become apparent. Although it is interesting to look back upon the various steps which have culminated in this realization, it is more important to appreciate that their greatest significance is to chart the path towards future progress.

Undoubtedly, one of the earliest chemical reactions ever studied was saponification and, until comparatively recent times, it has remained the only chemical reaction involving the fatty acids which has been utilized on a large scale. All the major uses of the glycerides have evolved from some intrinsic property initially present in the natural products. Thus, their long-established use in paints is dependent upon the characteristic drying properties of the glycerides of ethylenic acids. The chemistry and technology of the fats and fatty acids has, therefore, been largely confined for generations to a study of the saponification process or to methods of refining and blending for the improvement of an inherent property.

The last twenty-five years, on the other hand, have witnessed not only a great expansion of our knowledge of the fatty acids themselves but also the development of an appreciation of the many products which can be prepared from them. Higher aliphatic alcohols and their esters, dialkyl and alkyl aryl ketones, acyl halides, anhydrides, mercaptans, sulfones, sulfoxides, sulfonium compounds, esters, ethers, amides, nitriles, amines, and quaternary ammonium compounds are among the fatty acid derivatives which have come from the obscurity of rare chemicals to articles of commerce in this comparatively short period of time.

The early chemical literature contains a number of references to the preparation and properties of many of the fatty acid derivatives. Bouis and Carlet described the preparation of heptyl alcohol in 1862, and in 1883

Krafft published the preparation of the higher alcohols from decanol to octadecanol inclusive. In the previous year, Krafft had prepared many of the higher dialkyl ketones by the dry distillation of barium soaps. Carlet described stearamide in 1859, and Hofmann worked out methods for its preparation in 1882. The formation of nitriles by the dehydration of amides was published by Woehler and Liebig over a century ago, and Krafft described the preparation and some of the properties of the quaternary ammonium salt triethylhexadecylammonium iodide in 1889.

It is, therefore, evident that many of the fatty acid derivatives which have been extensively studied during recent years are compounds which have been known for a long period of time. Lack of interest in them may be largely attributed to the absence of commercially feasible methods for their preparation, combined with an ignorance of their major properties and potential uses.

Catalytic Hydrogenation

The catalytic hydrogenation of the alkyl esters of the fatty acids to higher alcohols, accomplished about 1930, offered the first new commercial source of a fatty acid derivative. It was soon realized that high yields of these alcohols can be obtained by the hydrogenation of the acids themselves. The higher alkyl hydrogen sulfates and their salts, which are easily obtainable from the higher alcohols, are now important wetting agents and detergents. The detergent properties of the soaps are due to the presence of the long hydrocarbon chains and the advent of these newer wetting agents was responsible for a greatly increased interest in the solution behavior of long-chain compounds. This has resulted in the development of a wide variety of surface active agents, many of which are or are destined to be important industrial chemicals.

High Vacuum Distillation

The fatty acids which are obtainable from any fat or fatty substance generally consist of a mixture of straight chain acids of various chain lengths and of different degrees of unsaturation. The heterogeneity of such mixtures greatly militates against their use in chemical synthesis, and material progress in this field had to await the discovery of satisfactory methods for the commercial separation of these mixtures into pure acids or mixtures of closely allied acids. High-vacuum distillation of the fatty acids has offered a satisfactory answer to this need.

The last two decades have witnessed the introduction of high-vacuum fractionating processes by which the acid mixtures are simultaneously and continuously separated into a series of components of different boiling points. Many studies have recently been made upon the low-temperature solvent crystallization of the fatty acids and their various derivatives.

Combinations of distillation and crystallization processes now permit the satisfactory separation of fatty acid mixtures into components of sufficient purity for chemical synthesis.

Research

It is not surprising that the availability of such a starting material has provided a great impetus for research upon the fatty acid derivatives. As a result of this work, commercial methods have been discovered for the preparation of many chemicals which were formerly laboratory curiosities and, in addition, many new compounds have been synthesized and their properties studied. Such studies have indicated a number of important commercial uses, and a continuation of these endeavors will greatly increase the importance of the fatty acids.

High Molecular Weight Amines

The high molecular weight amines present an interesting example of a series of compounds which can be synthesized from the fatty acids. The high molecular weight amines are not appreciably soluble in water; however, many of the salts are water soluble. If an amine salt contains at least one straight-chain hydrocarbon group of eight or more carbon atoms, it functions as a cationic colloidal electrolyte. Compounds of this class differ from the anionic colloidal electrolytes in that the colloidal aggregate is positively charged. Their adsorption characteristics, therefore differ from those of compounds such as soaps, alkyl sulfates, and alkyl sulfonates in which the colloidal particle possesses a negative charge. Among the many derivatives of the high molecular weight amines may be mentioned the quaternary ammonium compounds which represent a class of surface active chemicals of unusual interest.

Uses

Many of the fatty acid derivatives prepared during the last twenty-five years are now functioning as wetting agents, bactericides, insect and rodent repellents, water-proofing agents, and flotation agents, and are being currently found to be useful for many purposes. The progress made in the chemical utilization of the fatty acids is only one of the numerous examples in which chemical research has served to better utilize those natural products with which we have been endowed. The intelligent use of our great natural resources will surely be an important factor in our survival, both as a nation and as individuals. The chemist has played and will continue to play a dominant role in such undertakings. The expanding utility of the fatty acids is illustrative of the continued efforts of chemists to promote human welfare.

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The Chemist in the Glass Age

Dr. Alexander Silverman, F.A.I.C.

(Contribution No. 663 from the Department of Chemistry, University of Pittsburgh.)

THE Stone Age, the Bronze Age, the Iron Age have succeeded each other. Steam, electricity, radioactivity, atomic energy have taken their turns in advancing civilization, but an age seems to be christened for material things and not for energy. During the past quarter of a century man has become increasingly glass-conscious. Today, when THE AMERICAN INSTITUTE OF CHEMISTS celebrates the twenty-fifth anniversary of its birth, we are living in a "Glass Age." Although physics and engineering play their part, the accomplishment should be credited largely to the chemist. What the chemist has accomplished is noted briefly.

Metallic aluminum vapors have been condensed on glass surfaces for the production of mirrors. They reflect a larger portion of the visible spectrum than any other known metallic mirrors, and the light comes from the near side of the mirror. The aluminum mirror has been perfected to a degree where its surface is protected instead of being soft and easily scratched. Perhaps some day we shall use aluminum mirrors regularly instead of silver mirrors. During the war there was a scarcity of alumina. The chemist sought for substitutes and introduced the feldspars and syenite into glass batches. Aluminum metaphosphate glasses have been produced. These have new optical properties and are resistant to hydrogen fluoride fumes. Electro cast refractories of alumina are available. They are far more resistant for the melting of special glasses than the old fired clay refractories. Aluminum has been substituted for silicon in the silicate lattice in glass, in this manner making it possible to introduce more calcium and require less sodium. The products are far superior to the older glasses, and entirely new types for special purposes have resulted. In opal glasses it was found that by substituting the aluminum ion for the silicon ion in the silicate lattice, silica separated in colloidal or minute crystalline form. The introduction of this second quartzite phase of different index of refraction from the main body of the glass resulted in opalescence or in alabaster effects, depending on other chemical factors. These

findings of the chemist are important. They are significant not only in the case of the alumina substitution for silica, but can apply to any other glass-making element which can take a fourfold coordination.

The chemist has ascertained the nature of the red-coloring substance in selenium ruby glasses. X-ray photograms of cadmium selenium sulfide coincide with those of the selenium compounds in the glass.

The chemist has substituted barium compounds for lead compounds in flint and crown optical glasses and has used them for improving the workability and appearance of ordinary glasses.

Beryllium Glass

He introduced beryllia into glass and produced the first beryllium glasses. Not only are these of greater hardness, but possess other physical properties which are interesting. One of the beryllium glasses especially, the beryllium lithium borate, is so transparent to X-rays that it affords a window through which these rays pass and through which the operator can see from behind his lead-glass shield.

Boron has given us the high borosilicate glasses which we prize in the laboratory. These we now use generally in the kitchen. Also, boron compounds, usually as borax, commonly enter practically every ordinary glass of the day, bottle, window, etc., for improving the general quality.

Lime glasses, free from iron, which transmit the near-ultraviolet light, are among the chemists' products. Sunlight, whose ultraviolet was formerly absorbed by iron-containing window glass, may now be enjoyed through iron-free windows. Calcium metaphosphate has been introduced into glass—in fact, melts and produces a very simple glass of its own, a glass of fairly low melting point. This has desirable optical properties, the metaphosphate glasses, alone and with additions, will appreciably extend the horizons of glass science.

Carbon has gone into batch as cyanides for the reduction of copper and selenium compounds in the production of ruby glasses. The new process has the advantage that the color is produced directly in pots and tanks instead of requiring the reheating of glasses that were originally almost colorless. Oxalates have also been introduced by the chemist. They decompose and produce carbon monoxide which is a desirable reducing agent.

Cerium and titanium compounds have yielded beautiful canary-yellow shades. They are quite foolproof and relatively independent of oxiding and reducing influences.

Cobalt and nickel compounds have been studied by the chemist. They yield not only the characteristic blue and brown-colored glasses which have been known for many years, but a so-called black glass which is opaque

to visible rays but transmits the near-ultraviolet. These glasses are valu-able for fluorescence effects in the dark and found extensive application during World War II.

New Photographic Development

Copper, silver, and gold have long been in use in glass making and the color effects of their colloidal suspensions in glass are known. Opal glasses owe their opalescence to two media of different indices of refraction. But a new development has come about. Opal, copper, silver and gold glasses as they come from the pot in the new process are practically colorless, when they are exposed to the short ultra-violet for a sufficient length of time it is found that the exposed parts of the glass are sensitized and that on heating these to around 500 or 600° C (below the softening point of the glass) images, either in opalescent or white, or in the colors characterized by various colloidal sizes for the copper, silver, and gold, develop. It is possible to use negatives of special types for printing photographs deep in the glass, and the result is a three-dimensional photograph which is exquisitely beautiful. This new departure in photography is nothing short of remarkable, and it insures permanency. There is no danger of destroying the organic material of ordinary photographs, for the new ones are protected by the glass itself and are within its body. What photography and art will enjoy as a result of this discovery is incalculable.

Trace Materials

Sometimes the chemist finds that traces of materials are significant, as he has seen in the study of catalysts. He has observed that refined nitrates in glass do not produce the same effects as crude nitre. Now it happens that in caliche, the mineral from which nitre comes, small amounts of iodine compounds are present. The quantity is not large, but apparently produces some effect on the glass. It was found that by reintroducing a certain concentration of iodide into glasses made with the pure nitrates the desired effect could be reestablished.

Ferrous ions in glass absorb heat. Structural glass is now being produced which contains iron in the ferrous form to keep heat out of buildings in hot weather. Other glasses transmit heat rays which can be utilized for enjoying the warmth of solar radiation in cold weather. The chemist has also found that ferrous ions are effective in higher concentrations in goggles for preventing glare and for protecting the wearer from heat radiations in welding operations.

The less common elements have been introduced in various ways into glass. The chemist has increased the index of refraction far beyond that of the old glasses, and the range of

optical glasses has been extended almost beyond belief by researches that were carried on during the war. Resulting wide angle lenses for aerophotography have enabled aviators to photograph much larger areas than previously.

Lead, barium, and zinc oxides are common glassmaking chemicals. They corrode the refractory melting units. The chemist has produced the silicates of lead, barium, and zinc, directly from the ores in some cases. These are now employed instead of the oxides. They hardly react with the silica in the fire-clay, and corrosion is prevented. Greater uniformity results because of reduced contamination of the glass.

Manganese, as the dioxide, has been used for ages as a decolorizer, its pink effect compensating for the green color of ferrous ions. The chemist now introduces it in very large quantities, fabricating a black glass which absorbs light rays but transmits heat rays.

Neodymium and praesodymium have been used by the chemist. They produce a dichroic lilac, a glass which is lilac by transmitted light and rose by reflected light. Neodymium produces these colors. Praesodymium produces a beautiful green. Used together, the rare earth oxides, or prehaps carbonates or oxalates, yield a glass which has a grayish-lilac color which prevents glare and which accentuates reds and green—in other words, insures definition. The goggles afford the further advantage that they seem to penetrate fog better than ordinary lenses.

Oxygen in Glass

Oxygen was never thought of in glassmaking except for the oxidizing effects that air might have in glass production. Now the study of the finished glass itself reveals a startling fact—that glass is very largely oxygen, for every silicon atom in common glass is surrounded by four oxygens. Startling indeed is the knowledge that this element in the air we breathe is also one which is so large a portion of the product through which we see, and which protects us from nature's inclement weather.

The chemist has produced silicon mirrors on glass. These do not compare with ordinary metallic mirrors, but they are interesting in that organosilicon compounds are heated in the glass and decompose, depositing a highly-reflecting silicon mirror on the surface. Fused quartz which is made in vacuum-pressure electric furnaces is now being replaced by a glass which was quite ordinary to begin with, but which the chemist has leached with acid to remove almost all soluble components except the silica, and then re-fused. The resulting product is over 95 per cent silica. It transmits ultraviolet light, has the desirable thermal properties of fused quartz, and promises to become a very important science accessory. There is little doubt that it will be

used extensively in the production of lamps for sterilizing the atmosphere and that it will come into use in the laboratory for melting units and for general chemical use on account of its resistance to corrosion and because of its very low coeffieient of thermal expansion.

There was time when titanium was considered detrimental in glassmaking. Now the chemist finds that the titanium ion may take the place of the silicon ion in the silicate lattice and that when titanium replaces silicon, a variety of effects is produced. First, there may be transparent glass in which improved properties result. Second, the titanium replacing the silicon may cause it to be precipitated as silica in the glass, thus introducing a second phase with different index of refraction and producing not only opalescent and opal glasses, but intensely opaque products. This effect is particularly desirable in snow-white enamels.

The Versatility of Glass

What the chemist has accomplished during the last twenty-five years in glassmaking has been reviewed briefly. Certainly the past quarter century has blessed humanity through products resulting from the chemist's findings in the glass industry. We have lived in glass houses, at least some of us; in houses warmed or kept cool by glass wool, or foam glass, or radiation-absorbing or transmitting windows; in houses with clean atmospheres, through glass-wool filtration; in homes illuminated to our liking and perhaps equipped with special sun-ray or heat-ray units to guard health or relieve pain, respectively; perhaps even with special tube-radiators to destroy bacteria. If an operation has been necessary, the surgeon may have stitched us up with glass sutures.

Chemical studies of ray-transmitting and absorbing glasses have not only yielded the products mentioned, but also transparent containers for luminous sodium and other metallic vapors, and innumerable special types of glass to transmit or absorb any rays selected. There is a veritable rainbow of colored glasses for optical and other scientific use, and art enjoys over 50,000 color tones, in the Vatican studios in Rome, alone.

We do our laboratory work in a variety of scientific glass units; we cook and bake in the chemist's glass; we correct our vision through his lenses; we pierce fog with beams which pass through his special glass bulbs; and we record their reflections on chemically-treated discs.

The chemist, and the chemical elements at his command, now afford us an enviorment of our own choosing restricted only by our purse strings. We may have tropical, temperate, or frigid weather in our homes, enjoying sunrise, noonday warmth, the shade of dusk, moonlight, or darkness *ad libitum*. The chemist has created "The Glass Age".

The Chemists' Contribution to the Petroleum Industry 1923-1948

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THE past quarter century has witnessed the rapid growth of chemistry as a factor in all branches of the petroleum industry. In exploration, drilling, production, transportation, refining and marketing, the chemist has played a major role with the result that the Industry is now supplying consumers with over 5000 different products.

In locating oil, he has analyzed and studied rocks, minerals, sulfur beds, salt domes,, water, and gases. In drilling and producing oil he has developed alloys for drill bits, colloidal drilling "muds," special cements for sealing off water infiltration, acids to increase oil flow in wells, and chemicals to separate water from emulsified oils. In transporting oil he has developed special coatings, alloys, and chemicals to reduce corrosion of tanks, pipe lines, and pumps. Similar expedients have reduced corrosion in refinery equipment.

The progress in petroleum refining over the past twenty-five years has resulted largely from the application of chemical principles. The importance which refiners attach to chemical developments is reflected in the expansion of research staffs. As an illustration, one company employed thirty college-trained research scientists in 1924, and 150 in 1938; employs 300 at present and plans to employ a total of 420 in the near future.

Twenty-five years ago, refining processes were primarily physical separations. Gasoline was obtained from atmospheric distillation and from thermal cracking in Burton batch and semi-continuous units of about 200 bbl. per day capacity. The Dubbs continuous process was coming into wider use, and in 1925, cracking units had top capacities of 2,500 bbl. per day, a marked contrast with present day catalytic units, some of which process over 25,000 bbl. of gas oil daily and operate for over a year without a shut-down.

Gasolines of 1923 had a number of undesirable characteristics. Some contained an excess of low-boiling components which gave the motorist trouble with vapor lock. They tended to deposit gum on engine parts. Octane numbers were in the fifties and studies on the motor knocking

problem were still in their early stages. Gasoline containing tetraethyl lead was put on the market in 1923.

The yield of gasoline based on crude oil was only about twenty-five per cent a quarter of a century ago. Losses during refining were heavy compared to those of today. Sulfuric acid treatment to increase the color stability of gasoline and remove gum formers involved a waste of good oil. The vapor phase treating of gasoline with fullers' earth, which was put into operation in 1925, was a significant improvement in refining processes. In this treatment, gasoline vapors were passed through fullers' earth to remove gum and color-forming constituents. About 1930, inhibitors were used in gasoline to prevent gum formation and the need for acid or fullers' earth treating was eliminated in many refineries.

Research brought about a better understanding of the composition of motor fuel and the knocking properties of different hydrocarbons. It was found that cracked gasoline had better anti-knock properties than gasoline derived directly from crude oil. By 1930, the average octane rating of gasoline was about 60.

Catalytic Processes

A new era in petroleum technology characterized by the extensive use of catalytic processes had its real beginning about 1935. One of the earliest of these processes to be commercialized was polymerization. The gaseous olefins from cracking are polymerized using solid phosphoric acid catalyst to yield a gasoline of about 81 octane motor method and 93 octane research method. This process has resulted in both greater refining efficiency and better quality of motor fuels. The yield of gasoline is usually increased from two to four per cent in thermal cracking and five to ten per cent in catalytic cracking.

Catalytic dehydrogenation was also put into operation during this era. In this process, propane and butanes are converted to propylene and butylenes which are either polymerized to motor fuel or used in alkylating isobutane to produce aviation gasoline. The butylenes are also highly important as basic materials for synthetic rubber and plastics.

Catalytic cracking is probably the most important of all catalytic processes used in the oil industry. Commercial operations were begun in 1938. The first units employed fixed bed catalysts which required intermittent regeneration when they became coated with carbonaceous materials. Later developments employ Fluid flow and moving bed catalysts which make continuous operations possible. Once through yields of 45 to 55 volume per cent gasoline are obtained. These can be increased to 55 to 65 per cent by polymerization of gaseous olefins. Gasoline having 80 motor and 90 research method oc-

tane ratings are produced whereas thermally cracked gasolines average 68 motor and 76 research method. The higher boiling fractions of catalytically cracked gasoline contain sufficient high octane material to eliminate the necessity for recracking them, which is frequently necessary after thermal cracking if the higher end-point fractions are to be included.

Alkylation

The demands created by World War II speeded up the commercialization of other processes for increasing production of aviation gasoline, rubber, and toluene. Alkylation was important both in the aviation gasoline program and in producing styrene for copolymerization with butadiene to make GR-S synthetic rubber. The alkylation of isobutane with propylene, butylenes, or pentylenes using hydrogen fluoride or sulfuric acid catalysts gave 90 to 96 octane number aviation alkylates. Alkylation of benzene with ethylene yielded ethyl benzene, which was dehydrogenated to styrene. Isomerization was put into commercial operation during the war for converting normal butane to isobutane for alkylation, and normal pentane and hexane to higher octane isomers. Catalytic reforming in the presence of hydrogen, hydroforming, was used extensively in producing toluene from gasoline fractions containing methylcyclohexane.

Sweetening Agents

During the period from 1935 to 1941, much progress was made in the development of sweetening agents for improving the odors of gasolines. Earlier processes using sodium plumbite and copper salts had eliminated the foul odors of gasoline by converting the mercaptans to disulfides which were left in the gasoline. These disulfides, although odorless, are detrimental in that they decrease susceptibility to antiknock improvement by tetraethyl lead. The Solutizer process, developed later, extracted the mercaptans by solutions of sodium hydroxide containing isobutyrates. The Unisol process using methanol and caustic soda is a greatly improved process for removing the mercaptans.

Lubrication Improvements

Improvements in lubricating oils were likewise made as their chemical composition became better understood. The cold weather starting problem was attacked with more effective results after the viscosity index scale clarified the confusion arising from the indefinite characterization of motor oils supplied as light, medium, and heavy. By 1930, solvent extraction methods were being widely used to improve viscosity index. This process also increased oxidation stability of the oils. Oxidation inhibitors made a further improvement. About this time, pour point depressants also came into use. These additives made it

possible to use oils without dewaxing and resulted in better quality because the wax-containing oils have superior lubricating properties. Other additives improve viscosity index, inhibit bearing corrosion, promote detergent action to keep bearings clean, increase oilness under extreme pressure, and reduce foaming tendencies.

Natural Gas

A discussion of important chemical developments in the petroleum industry would not be complete without some mention of the dramatic role of natural gas. Recent adaptations of the Fischer-Tropsch process are resulting in the construction of two plants which will together produce about 11,000 bbl. of 80-octane gasoline, 2,000 bbl. of diesel fuel, and 600,000 pounds of oxygen-containing organic chemicals daily from 175,000,000 cubic feet of natural gas.

Chemicals from Petroleum

Twenty-five years ago, the production of chemicals from petroleum was almost zero. In 1925, total production amounted to about 150,000 pounds annually which is in sharp contrast with the present output of over 3,500,000 pounds. As late as 1935, only one oil company was classified as a chemical manufacturer whereas there are fifty at present. Such basic chemicals as aliphatic alcohols, aldehydes, acids, and ketones are produced from the oxidation of petroleum gases, liquids, and waxes. Other basic materials are provided through the halogenation, nitration or sulfonation of hydrocarbons. Among the important basic chemicals extracted directly from petroleum are napthenic acids, phenols, cresols, xylols, and mercaptans. Commercial processes of particular significance have been developed for the manufacture of phthalic anhydride and glycerine from petroleum. The glycerine process gives a number of by-products such as the soil fumigant D-D which is a notable contribution to agriculture.

That the petroleum industry will become more and more chemical is predicted not alone from its increasing interest in chemical manufacture but on more exacting demands for tailor-made motor fuels and other products. Research in the automotive industry is bringing forth engines which will require large volumes of the higher octane fuels which the petroleum industry can supply. Fuels of even more rigid chemical specifications will be a necessity in the future.

Chemical know-how is also one of the greatest factors in crude oil conservation. The savings from the use of thermal and catalytic cracking processes is about 2,500,000,000 bbl. of petroleum annually. It is certain that future developments will extend our oil reserves.

Contributions of Chemists to the Pharmaceutical Field 1923-1948

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THE twenty-five years since the founding of THE AMERICAN INSTITUTE OF CHEMISTS have witnessed more advance in the treatment of disease by means of synthetic chemicals than had been accomplished in all previous history. This advance has been possible by the teamwork of chemists working with medical scientists in the fields of pharmacology, bacteriology, mycology, parasitology, pathology, and clinical medicine. While the clinician, because closer to the patient who benefits, usually receives a major share of the public recognition for a new drug treatment, chemists who first synthesized the drug may deserve (and usually receive) the plaudits of scientific circles.

The forgotten men in recognition, but who are the indispensable linemen in the team, are those chemists and chemical engineers who take a wholly impractical laboratory synthesis and improve it to the point where the drug can be produced at a price the patient can afford to pay. This price must at the same time make sufficient profit for the manufacturer to support the tremendously costly research leading to the new drug and its acceptance for sale by the Food and Drug Administration. The manufacturer must further pay for an expensive manufacturing plant which may be obsolete in a year or two through development of a better drug.

Listing of the major developments of the period is all that can be covered in this brief article, so huge has been the number of the advances and the resulting literature.

Chemotherapy of Infectious Diseases

Chemists have synthesized more than 3500 derivatives of the parent drug, sulfanilamide. Of these, about ten are of clinical importance, while sulfadiazine is the most generally useful. These drugs cure many of the common infectious diseases of bacterial origin: meningitis, pneumonia, dysentery, gonorrhea and chancroid. They are also effective in animals and poultry. Human lives saved by these drugs number at least 50,000 annually in the United States.

British and American chemists launched an intensive drive for the development of better antimalarial

drugs during World War II and succeeded in finding three or four offering advantages over quinine and quinacrine (Atabrine). Quinacrine was placed in very large scale production by American chemists during the war and played an important role in protecting our troops in the tropics.

The spectacular development of the antibiotic drugs, while primarily an achievement of mycologists and bacteriologists, has witnessed important contributions by chemists in isolating pure products, in determination of structure and in synthesis. Penicillin and streptomycin are in large scale production while bacitracin, polymyxin, aerosporin, subtilin, lichenformin, and chloromycetin have shown clinical promise and are being intensively studied.

Filiariasis, a tropical, worm disease responsible for the development of elephantiasis, shows promise of cure through the recently developed Hetrazan, or 1 - diethylcarbamyl - 4 - methylpiperazine.

Improvements have also been made in drugs containing arsenic, antimony or bismuth for treatment of syphilis, schistosomiasis, and trypanosome disease.

Chemotherapy of Non-Infectious Diseases

The treatment of non-infectious diseases by specific chemical agents is a fairly recent concept but would include the use of vitamins and hormones in treatment of diseases caused by deficiencies of these, as well as the use of specific chemical substances to inhibit the action of chemical regulators of body processes when these are present in excess and are themselves the cause of disease. The accomplishments in this field are truly dramatic and are but the start of another revolution in medicine.

The isolation, degradation, and synthesis of the vitamins have been a series of brilliant chemical achievements of recent years. The following is a chronological history of the synthesis:

Vitamin	Synonym	Date Synthesized	Deficiency Diseases Cured
Vitamin B_1	Thiamin	1930	Beri-beri
Vitamin D	Calciferol Viosterol	1931	Rickets
Vitamin C		1933	Scurvy
Vitamin B_2	-Ascorbic Acid	1935	Pellagra, Keratitis
Vitamin A	Riboflavin	1937	Night blindness
Vitamin E	-Tocopherol	1938	Sterility
Vitamin B^6	Pyridoxin	1939	Nausea of pregnancy

Vitamin K_1	1939	Bleeding
Pantothenic Acid	1940	Dermatosis (in chicks)
Biotin	1943	Dermatitis
Folic Acid Pteroylglutamic Acid	1945	Macrocytic anemia, Sprue

In addition to the above older compounds, nicotinic acid and nicotinamide, p-aminobenzoic acid, and inositol were identified as vitamins during this period.

Similarly the isolation, structure determination and synthesis of hormones has been a succession of triumphs for chemists. In the case of the sex hormones it has been possible to synthesize analogues having the activity of the natural product but capable of oral administration.

Many of the diseases caused by allergy such as hay fever, urticaria, and serum reactions have been relieved by the recently developed antihistamine drugs.

Hyperthyroidism, brought about by excessive production of the thyroid hormone, can now be treated with propylthiouracil and the dangerous operation of removing part of the thyroid gland averted in many cases.

Other Drugs

While the most spectacular advances have been made in chemotherapy, there have been many improvements made in drugs for the diagnosis and symptomatic treatment of disease and as adjuncts to surgery.

In the first group are better X-ray contrast agents. Among drugs for symptomatic treatment of disease are: better analgesics, some of which are more powerful than morphine and less apt to produce habituation; better diuretics; sympathomimetric, parasympathomimetric and anti-parasympathomimetric agents; and improved barbiturates for sedation or hypnosis.

As surgical adjuncts we might list improved topical germicides; chemically pure curare, and synthetics having similar action for producing relaxation of muscles during surgery; new general anaesthetics such as cyclopropane and vinyl ether; intravenous anaesthetics such as the thiobarbiturates and caudal anaesthetics (for childbirth).

We of the chemical profession can take great pride in our contributions to the conquest of diseases that have plagued mankind since earliest history. The advances made are but a start, however. There remain infectious diseases caused by viruses, fungi, helminths, and protozoa which should be amenable to chemotheraphy but, as yet, lack the specific agents.

Arthritis, rheumatic fever, cancer,

and cardio-vascular diseases are leading causes of morbidity and death in that ascending order. It is not too much to hope that the current renaissance of chemotheraphy will carry enough impetus to conquer these baffling diseases.

Booklets

"Resin Data Sheet DC 801-804," "Curing Silicones," Revised Data Sheet DC-4," "Pan Glaze pamphlet," and "Silicone Notes" Recent data to bring previous material up to date. Available from Dow Corning Corporation, Midland, Michigan.

"Publications Periodiques 1948". Leaflet listing new books on science and the social sciences. Presses Universitaires de France, 108, boulevard Saint-Germain, Paris (6) France.

"The Master Crystal Model Set." Leaflet describing set of plastic rods and rubber balls from which the structure of molecules and crystals may be reproduced in three dimensions. Paul Bonhop, Inc., 164 John Street, New York 7, N. Y.

A Study of the Lanham Trade Mark Act." Prepared for the NAM Committee on Patents and Research by the NAM Subcommittee on Trade-Marks. National Association of Manufacturers, 14 West 49th Street, New York 20, N. Y.

Communications

Received Too Late for April Chemist

To the Editor:

Supplementing the report of the meeting of the Baltimore Chapter at the H. B. Davis Company plant, (See April CHEMIST, page 163) I would like to add the following. This is to be inserted after the first paragraph and before the second:

"One of the unique demonstrations to the group was the three methods used by this Company for producing varnish. (1) The old type Open Fire Systems which were operated by fuel oil and radiant dome fires. (2) Large electrically heated kettles. (3) Newest type of large varnish and resin kettles which operate with heat supplied by illuminating gas. The visitors were told that this last type of equipment was the most efficient and up-to-date in the industry at present."

—Ralph W. Lamenzo, F.A.I.C.

Missing Number Sent

To The Chemist:

I did not receive the February copy of this magazine . . .I enjoy it so much that I don't want to miss one, so would you please send me the missing issue.

—Annette Strong, A.A.I.C.

Advances in Printing Ink Manufacture 1923-1948

F. Grant Schleicher, M. Sc., F.A.I.C.

President, W. D. Wilson Printing Ink Company, Ltd., Long Island City, N.Y.

FUNDAMENTALLY the progress of any industry can be measured in terms of new and available raw materials that have properties which can be formulated into products that meet the advancing technique and requirements of the consumer industry.

This is particularly true of the printing ink industry to which hundreds of new materials have become available during the last twenty-five years. Also, there is at present a large number of untried products with excellent potentialities.

Prior to 1923, the principle raw materials used were: (1) Rosin, rosin esters, gilsonite, shellac, and fossil resins as Demar, Kauri, Congo, and Manilla; (2) Linseed oil, fish oil, rosin oils, stearine pitches, and mineral oils; (3) Carbon blacks (channel), lamp black, bone black, iron blues, chrome yellows, lake yellows, ultramarine blue, alkali blue, blue lakes, para reds and lake reds as eosine. White pigments were lead, zinc, barytes, lithopone, chalk. Oxidising agents or driers were principally lead or manganese linoleates or resinates.

With the advent of synthetic resins of the phenol-formaldehyde type (Bakelite) in 1925, research in the printing ink field rapidly expanded. A great part of this work was done by the resin and varnish chemists and adjusted to ink formulation. The combination of these products with tung oil gave materials which allowed the ink maker to produce inks with greatly improved qualities in drying, gloss, and hardness.

From 1935 to 1937, a threatened shortage of tung oil forced the chemist to formulate inks with substitutes for this oil and further research on chemically treated linseed oil was tried with good results. The varnish and allied trades rapidly produced improved, conjugated, and fractionated oils from castor oil, soya bean oil, oiticica, and other oils chiefly of vegetable origin.

With the advent of war, these oils and various substitutes were used, with many of doubtful value; but with a greatly increased knowledge

of oils and their properties, a few oils of permanent value were developed. Correlated with this work was the introduction of many new resins and plasticisers. Phenolics, alkyd, maleates, ureas, pentaerythritol, ethyl cellulose, chlorinated rubbers, styrenes, allyl starches, polymerized hydrocarbons, and others have offered possible formulations of limitless numbers and increased values. Further, these products offer possible additive improvements with the older fossil resins and rosin.

As the limits of speed of setting and drying of the oil or varnish base inks was reached, the solvent type ink was introduced and this rapidly increased in use. Aniline and rotogravure inks are being used in increasing amounts yearly and still have undeveloped fields. The use of a resin, a plasticiser, and pigment in high concentration reduced with a solvent such as alcohol, toluol, or mineral spirits, allows printing speeds of five-hundred or more feet per minute with one to four colors, and with a gloss overprint. For printing on cellophane, glassine paper, or metallic surfaces, these inks at present are superior to the oil base inks.

Paralleling this type of ink are new formulations of the oil or varnish base inks which use heat, steam, infrared lamps, and other agents to polymerize the ink from a fluid state to a solid phase. In these inks there is an advantage of a heavier film with greater opacity, permanency, gloss, and a wider range of colors.

The change in pigments has been great, and with the introduction of titanium, a great advancement was made in opacity and inertness to chemical change. Further development from the anatase to rutile crystal form gave still greater opacity. Chalk, clay, and similar white extenders are now being treated with surface active agents, giving new and improved qualities to these older products. Research on white lead, flake white, and zinc oxides, indicates that these products will have increased value to the ink maker when treated in a similar manner.

Lamp black and carbon black have been improved and research has developed new types of these with greatly improved opacity, flow, and color. The furnace type blacks have several advantages in working qualities as well as in price.

The blue lakes on a phospho-tungstate or molybdate base have given very permanent blues. The development of pthalocyanine blues (Monastral) and green have given the industry a new group of permanent blues which, in spite of a high price, are of value, especially when certain tints as well as brilliant shades are required.

Among the reds, the lithols have been a great advance over the paras, eosines, and older type colors. Non-bleeding reds of a bluish shade, as

well as the new Bon-Ton reds offer great advantages both as to color and permanency. Further these colors, like many others, combined with selective surface activating agents will give additional properties, which makes the older colors more valuable than before.

The older types of yellow lakes have been superseded in many but not in all cases by benzidine and Hansa yellows which give greater permanency and light fastness.

Experimental work in the laboratories of the color industry indicates that many of the colors used by the printing ink industry at the present time will soon be greatly improved. Some of these colors when tried out as inks have not met with the success expected. However, some show excellent possibilities, and when the raw materials become more available, they will be in general use.

For cheaper types of inks, there are several synthetic iron oxides which may be used as extenders for red or brown inks.

Within the past ten years there has been developed an entire new field in surface active wetting agents which aid in producing easier grinding and finer dispersed inks. There are several groups of these and the current technical literature contains data of value to those who read.

The present situation clearly indicates a tremendous growth in the printing ink industry for the next few years, if not longer. The extension of the industry with its new products into the plastics field, textile and decorative arts, is not a question of time but one of development. Many fine products now on the market are based on printing inks of the latest formulation.

Upon looking over the industry for some years and evaluating the new raw materials and their possibilities, one can optimistically state, "It is only the beginning; the best is yet to come."

Relations between management and non-management personnel in an organization, like other human relations, are not static. They require constant attention and constructive actions to meet new situations.

—Annual Report issued in April 1948.
Standard Oil Company (New Jersey)

The Chemists' Contributions to the Rubber Industry During the Past Twenty-five Years

Dr. Harry L. Fisher, F.A.I.C.

Director of Organic Research, U. S. Industrial Chemicals, Inc.
Stamford, Conn.

TWENTY-FIVE years ago the rubber industry was already out of the "horse-and-buggy" age, yet during this quarter of a century there have been many new developments. Some of these were made by engineers and some by physicists, but most of them were made by chemists.

When the period began, practically all the technical and scientific work being done in the rubber field was on natural rubber. However, the study of methods of making synthetic rubbers was revived in earnest shortly afterwards in Russia, Germany, and this country, and the first commercial synthetic rubber was the accomplishment of American chemists, Thiokol, which was introduced in 1930. Neoprene, known first as Duprene, came on the market in 1932, and in the same year the Russians announced the manufacture on a pilot plant scale of a sodium polybutadiene rubber. Koroseal, a highly plasticized polyvinyl chloride, was an American development, 1935, and in the same year, the German Buna sodium polymers of butadiene were produced. In the meantime the Germans were also busy developing the method of emulsion polymerization and in 1937 large scale manufacture of Buna S from butadiene and styrene, and Buna N from butadiene and acrylonitrile was begun.

Theoretical and practical work on both natural and synthetic rubbers during all these years showed considerable advance. Interesting and excellent work was accomplished in all of the many and varied phases of rubber itself and its manufacture.

In the early twenties latex was very much in the development stage. Processes were being investigated and commercialized for concentrating it by centrifuging, creaming and evaporation. The rubber world was very much interested in the electrodeposition of rubber from latex on metal and porous forms and astounded by the process for vulcanizing rubber as latex. Much work was done on the preservation of latex for shipment to make it available in the new processes of rubberizing tire cords by impregnating them with compound latex, of foaming the latex for use

in upholstery, and of making all kinds of dipped goods. Latex methods literally drove the smelly old cold cure process right off the market. New methods in rug making and in the manufacture of rubber thread followed in due season. Also there was developed from latex the interesting multipore rubber sheets of both soft and hard rubber containing a multitude of tiny holes for use in filtering processes, garments and batteries. Finally there should also be mentioned the methods of redispersing rubber and reclaimed rubber to make artificial latices. Yes, latex has been a most interesting material.

For a long time the great bulk of of rubber has gone into tire casings and tubes. Competition was strong and chemists vied with each other to make better compounds to make better tires. Such competition was a healthy sign and the public benefited greatly by it in both service and price. There were differences in the vulcanization of different batches of natural rubber but these were "ironed out" by the addition of the necessary stearic acid to all batches to make sure that there was enough organic acid in each batch for proper vulcanization.

Accelerators

Mercaptobenzothiazole is an accelerator that gives a "table-top" cure because it allows vulcanization to take place over a fairly long period of time with no serious drop in the properties of the vulcanizate, thus giving a perfect cure inside as well as outside of thick articles of rubber like tire casings. Also, this accelerator gives good aging properties to the vulcanizate. Its tendency to scorch was curbed by combining it chemically with other compounds and for a long time it alone and in these chemical combinations has been the most important organic accelerator. Furthermore, a vast amount of work was done in both the theory and practice of acceleration and the making of other important accelerators that were developed for different purposes.

Antioxidants

Age resistors or antioxidants, that protect rubber in the presence of air and can be included in a rubber compound without upsetting the course of vulcanization, were one of the developments of this period. It was not long before practically every rubber compound contained one of these protective non-accelerating antioxidants. Other substances helped to slow down the action of light and heat, but in these properties as well as in protection against ozone natural rubber is poor and has had to give way to the superior properties of certain of the synthetic rubbers.

Compounding Ingredients

Much work was done on general compounding of natural rubber and the development of new compounding ingredients. New carbon blacks, a finely divided silica known as "white soot," finely divided calcium carbon-

ate with the particles coated with stearic acid or tall oil, aluminum hydroxide, aluminum silicate, hydrated calcium silicate, and others came into regular use. Also new plasticizers, softening agents, stiffening agents, organic coloring materials, peptizing agents, tackifiers, flame retarders, and organic non-sulfur vulcanizing agents.

Rubber for better electrical insulation was prepared by removing the protein and other water absorbents, and, marvelous to say, by the incoration of certain types of carbon blacks, rubber was made electrically conducting.

Much work was done on all kinds of methods of testing, physical, electrical, aging by bomb in air and oxygen, heat aging,testing for fatigue, abrasion, and flex crack resistance, hysteresis loss, and plasticity, and on the correlation of some of these. Physicists and engineers helped in these methods but the chemists were there also.

Rayon cords made better tires but before they could be used a great deal of work had to be done to make the rubber adhere to them. Phenolic resins were very useful in solving this problem.

Cements

Rubber is resistant to the action of many corrosive chemicals but in order that this property could be used it had to be attached to metal as a support. The important cements for this purpose were made from rubber itself by the process known as cyclization. Also the old brass-plating method was improved and rubber attached to metal for many other purposes including motor mounting for "floating power." Steel wires have been treated and used successfully in place of cotton and rayon cords in tires, and even fiber glass cloth has been used in experimental tires.

Besides the cyclized rubbers many other chemical derivatives have been made but only a very few have been commercialized. Chlorinated rubber is used for paints and cements, and rubber hydrochloride as a transparent packaging film. Cyclized rubber is used not only for cements but also for paints and as a "reinforcing" compounding material for rubber articles.

The reclaiming of worn-out rubber articles was a real factor in our domestic and war economy. Advances have been made and the reclaiming even of synthetic rubber is a regular part of the industry.

Synthetic Rubber

Of course the greatest achievement of all and one with which everyone is familiar because it was so recent is the development and manufacture of synthetic rubbers during the war. The manufacture of 724,859 long tons of GR-S during the year 1945 tells a wonderful story. Butadiene and styrene had to be made on a tremendous scale. An enormous amount of fine

work went into their development and into the methods of synthesizing, compounding, vulcanizing, and testing of GR-S and its vulcanizates, and the cooperation of the chemists in many rubber companies and certain universities played a large part in making these things possible. Although GR-S did not equal natural rubber in all its properties, it was used for 90 per cent of its normal applications. Now a GR-S is being manufactured that practically equals natural rubber in all its properties and excels it in resistance to abrasion and heat. Other synthetic rubbers are used where natural rubber is completely inadequate.

Thus progress continues to march on.

Patent Department Added

Bjorksten Research Laboratories, 185 No. Wabash Avenue, Chicago 1, Illinois, announce the addition of a patent department to be headed by Dr. Johan Bjorksten, F.A.I.C., president of the Laboratories.

Bee Chemical Elects Vice President

The Bee Chemical Company, Chicago 1, Illinois, announces that M. A. Self has been elected vice president in charge of sales and a director of the company.

Books Announced

"Market Guide for Latin America." Lists some 85,000 buyers, agents, manufacturers, retailers, exporters, etc., in all countries of South and Central America. Special features include market survey of each country, patent and trade mark requirements, import-export figures, electric current characteristics, etc. Descriptive folder, showing auxiliary services and subscription, is available from American Foreign Credit Underwriters Corporation, 170 Broadway, New York 7, N. Y.

"Encyclopedia of Chemical Technology." Vol. I. Edited by Raymond E. Kirk, F.A.I.C., and Donald F. Othmer, F.A.I.C. 1006 pp. 7¼" x 10¼". $20.00. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y.

"Directory of Engineering Data Sources." Technical Pub. No. 482. A reference guide intended for use by research and design engineers, professors, consultants, librarians etc. 65 pp. 6" x 9". $2.50. Southeastern Research Institute, Inc., 5009 Peachtree Road, Atlanta, Georgia.

Coffee Yields Shampoo

Robert Brown, president of Coffette Products, Inc., Brooklyn, N. Y., manufacturing chemists, announces that this firm is producing a new hair shampoo processed principally from coffee.

Some of the Benefits of A. I. C. Membership

The members of THE AMERICAN INSTITUTE OF CHEMISTS who joined in 1923, our founding year, were asked, "What Benefits did you receive from A.I.C. Membership?" The replies are varied, but they may be classified loosely into professional status, personal contacts, and individual benefits.

Professional Status

Professional Status.

—William S. Arnold,
Recording Secretary, Director of Research and Production
The C. M. Pitt & Sons Company,
Baltimore 30, Maryland

Articles in THE CHEMIST and the membership Directory.

—Roy C. Charron,
Director of Laboratories,
The U. S. Envelope Company,
Worcester, Mass.

Pride in being a charter member of such a worth-while organization.

—John W. Crawford,
President, Treasurer,
Crawford Industries, Inc.
Judge of Tilton Municipal Court
Tilton, N. H.

The sense of professional solidarity which enhances the worth of the individual's contribution to the profession.

—Dr. M. L. Crossley,
Research Director,
American Cyanamid Company,
Bound Brook, N. J.

I as well as the whole profession have certainly gained through the activities of the INSTITUTE in developing the professional standing of chemists. As it happens, for twenty-four of the twenty-five years of the life of the INSTITUTE, I have been in the West and have been always employed in an industrial capacity. I have, therefore, not had direct contact with the activities of the INSTITUTE, particularly in the field of practicing chemist. It has been, however, a very great pleasure to sit back and watch the growth of the INSTITUTE which we started twenty-five years ago and to be able to see how our infant has grown in size and strength until it is a real and important factor in determining the professional situation of chemists today.

—Lloyd L. Davis,
Supervisor of the Process Division,
Continental Oil Company,
Ponca City, Oklahoma

The opportunity of advancing the professional recognition of chemists.

—Ralph B. Deemer,
Retired Economic Analyst,
U. S. Department of Commerce,
Washington, D. C.

The satisfaction that I was assisting the effort of the A.I.C. in improving the status of chemists.

—Charles A. Fort, *Chemist*
U. S. Department of Agriculture
Bureau of Agricultural and Industrial Chemistry
New Orleans 19, La.

Fellowship in THE AMERICAN INSTITUTE OF CHEMISTS.

—Dr. Seymour M. Hermann,
Retired President and Director of Chemical Research,
Apex Chemical Company,
New York, N. Y.

I became a member of the A.I.C., and continued in that I wanted to support an organization for the betterment of the status of the chemist.

—Dr. Edwin E. Hutching,
Retired Director,
Pacific Medical Laboratories,
San Francisco, Calif.

It keeps me informed of the newest developments and progress in the profession of chemistry.

—Norris R. Kosches, *Teacher*
Lyndhurst High School,
Lyndhurst, N. J.

Economic and professional improvement.

—Albert J. Kroner,
Head of Science Department
Teaneck High School,
Teaneck, N. J.

Professional orientation not available to me from any other source.

—A. C. Lansing,
Vice President and Director,
Foundry Development Engineers, Inc.
Detroit, Michigan

The increasing recognition by the chemists themselves, by the employers, and by the public that chemistry is a real profession is of definite benefit to every chemist.

—Dr. Ralph E. Lee,
Retired Director,
Department of Applied Research,
Standard Brands, Inc.,
New York, N. Y.

Professional status.

—James J. Lichtin, *Chemist,*
Verona Chemical Company,
Newark, N. J.

A corrective for technical society membership.

—Dr. Stewart J. Lloyd, *Dean,*
School of Chemistry,
Metallurgy & Ceramics,
University of Alabama,
University, Ala.

The knowledge that I have contributed to the solidarity of the A.I.C.

—Frederick G. Manwaring,
Consultant
Maywood Chemical Works,
Maywood, N. J.

Association and working with and for an increasingly more highly regarded professional group whose ethics have undoubtedly bettered others.

—Dr. Norris W. Matthews,
Chemist
Applied Research Laboratory
U. S. Industrial Chemicals, Inc.,
Baltimore 3, Maryland.

The satisfaction of belonging and in slight measure supporting the A.I.C.

—Dr. Jack P. Montgomery,
Professor of Organic Chemistry,
University of Alabama,
University, Ala.

I have looked upon my membership as a contribution to the profession, rather than as an investment.

—William H. Rinkenbach,
Chief,
Research Section,
Picatinny Arsenal,
Department of the Army,
Dover, N. J.

I have a better appreciation of chemistry as a profession.

—Prof. Alfred M. Peter,
Emeritus Professor of Soil Technology,
University of Kentucky,
Lexington 29, Ky.

Received publications and was kept informed of legislation.

—J. C. Rambo,
Retired Chemist
N. Y. Navy Yard,
Brooklyn, N. Y.

I became a member in 1923 not expecting any personal gain, rather to do my part to aid the advancement of the chemists' profession, though the benefits received have been everything A.I.C. was founded for except State license for the profession, and that in time will come.

—Richard B. Sheridan,
Superintendent,
Heat Treating,
J. H. Williams & Company,
Buffalo 7, N. Y.

Every chemist has benefitted whether a member or not, because the A.I.C. has materially advanced the recognition of chemistry as a true profession.

—Nathan Smith,
Pharmaceutical Consultant,
4115—76th Street,
Jackson Heights, L. I., N. Y.

Enjoy prestige of fellowship and made conscious of the importance of the non-academic aspects of the profession.

—Raymond Szymanowitz,
Technical Director,
Acheson Colloids Corporation
Newark 2, N. J.

A feeling of professional unity among chemists.

—Vincent C. Vesce,
Vice President and Technical Director,
Harmon Color Works, Inc.,
Paterson, N. J.

Greatest satisfaction derives from the generally improved professional and economic status of chemists.

—Glenn H. Wagner,
Assistant Director of Research,
Aluminum Company of America,
East St. Louis, Illinois.

Professional News.

—M. G. Weber,
Consulting Chemist,
Maplewood, N. J.

Professional prestige.

—Edward G. Williams,
Consulting Industrial and Engineering Chemist,
The Edward G. Williams Laboratories,
New Orleans, La.

Personal Contacts

Good fellowship.

—William G. Bond, *Retired President* F. F. Slocomb Corporation, Wilmington, Del.

Delightful associations and valuable contacts.

—William J. Cotton,
Consulting Chemist,
Butler, Penna.

Local meetings and THE CHEMIST

—Leland A. Dubbs,
Private Research,
22108 S. Avalon Blvd.,
Torrance, Rt. 2,
L. A. County, Calif.

Friendships which have been, and still are, mutually helpful in many ways.

—Dr. Harry E. Dubin,
H. E. Dubin Laboratories,Inc.
New York 17, N. Y.

Association of fellow members.

—Ernest G. Jarvis, *President,*
Continental-United Industries Company, Inc.,
New York, N. Y.

Received an interesting magazine and met some interesting people.

—John W. McBurney,
Technologist,
National Bureau of Standards
Washington 25, D. C.

Acquaintanceships.

—A. J. Pastene,
Plant Manager,
Monsanto Chemical Company,
J. F. Queeny Plant,
St. Louis 4, Missouri.

Social contacts with area chemists.

—Ernest B. Phillips,
Chief Chemist
Sinclair Refining Company,
East Chicago, Indiana.

Acquaintance with other members.

—Francis G. Rawling,
Process Consultant,
West Virginia Pulp & Paper Company, New York, N. Y.

Meeting members of the profession in a social way; non-technical.

—Solomon Schneider,
Senior Chemist,
Navy Department,
Naval Shipyard,
Philadelphia, Pa.

Friendships.

—Dr. John A. Steffens,
Consultant,
New York 6, N. Y.

Social.

—W. L. Tanner,
Chief Chemist,
Reade Manufacturing Company,
Jersey City 2, N. J.

Personal contacts with members at meetings.

—R. A. Worley,
Retired,
Trenton, N. J.

Both Professional and Personal Contacts

Stimulation of professional consciousness; many fine contacts.

—Dr. James F. Couch,
Senior Chemist,
Eastern Region Research Laboratory, U. S. Department of Agriculture, Wyndmoor, Philadelphia 18, Pa.

Moral support, and sharing experience with other fellow members of the A.I.C.

—Gabriel D'Eustachio,
Chief Research Chemist and Metallurgist,
General Cable Corporation,
Bayonne, N. J.

Fellowship with men and women having a common objective to improve the economic and social status of the chemist.

—James N. Taylor,
Retired Chemical-Economist,
Chemical and Drug Division
Bureau of Foreign and Domestic Commerce
Washington, D. C.

Kept informed on the relation of the chemist and the other professions to the public and to private enterprise, wider perspective, and personal contacts.

—George T. Tobiasson,
Supervising Chemist,
Universal Oil Products Company,
Riverside, Illinois.

A broad and pleasant acquaintanceship both at home and abroad; comfort in professional recognition which implied that however dubious my interests and occupation might seem to the uninitiated, my educational background and experience must have been satisfactory or I should not have been admitted to the Institute. Finally, my experience in public relations for the INSTITUTE and especially as editor of THE CHEMIST has been of practical value in much that I have done since that time.

—Florence E. Wall,
Consultant;
General Technical Writing; Specialty, Cosmetics and Cosmetology.
New York, N. Y.

Individual Benefits

Probably considerable indirect benefits.

—Vernon C. Allison,
Lambertville, N. J.

Younger chemists are better off financially than before.

—Edwin Dowzard,
Retired Chief Chemist and Director of Research
N. Y. Quinine & Chemical Works, Inc.,
Brooklyn, N. Y.

Prestige and honor of having the backing of such a well worth-while association.

—Albert H. Grimshaw,
Professor,
Textile and Dyeing Chemistry
North Carolina State College,
Raleigh, N. C.

Increased pride in the profession. Indirectly received benefits of improved status of chemists as a group, and much stimulation from articles in THE CHEMIST.

—Robert A. Webber,
Assistant Director of Research,
Brown Company,
Berlin, N. H.

Self-confidence. I was in some ways useful to the INSTITUTE. I prepared, multigraphed and mailed out the early *Bulletin;* my office was used for Council meetings, etc. This gave me needed self-confidence.

—Calm M. Hoke, *Chemist*
Jewelers Technical Advice Company,
New York 7, N. Y.

Developed my personality and stimulated ambitions to become something more than a drudge.

—Charles F. Smith, Jr.,
Assistant Sales Manager,
U. S. Rubber Reclaiming Company, Inc.,
New York 18, N. Y.

The satisfaction of belonging to a useful group whose policies I have usually approved and in which I have on occasion had the opportunity to express my views.

—Dr. Martin Meyer,
Professor and Chairman,
Department of Chemistry,
Brooklyn College,
Brooklyn, N. Y.

The A.I.C. was very effective in securing serious consideration by N. Y. City administration of low salary schedules in 1929-1930. Substantial improvement resulted.

—Benjamin Janer,
Consulting Chemist
Borough of Manhattan,
Municipal Building,
New York, N. Y.

Prestige and present affiliations.

—Roy Wisdom,
Plant Manager,
Taylor White Extracting Company,
Camden, N. J.

Opportunities

Civil Service Examinations

The Board of U. S. Civil Service Examiners, Army Chemical Center, Maryland, announces unassembled examinations for chemists P-2 through P-4, $3397 to $4902 and P-5 through P-8 $5905 to $9975 per annum, for probational appointment at Army Chemical Center, Camp Detrick, Frederick, Md. and Aberdeen Proving Ground, Md. Titles open are analytical chemist, biochemist, explosives chemist, general chemist, chemist, organic chemist, pharmaceutical chemist (except P-5 through P-8), and physical chemist. Applications should be filed with the office of the Executive Secretary at the address given at the top of this paragraph, not later than June 2, 1948. Request Announcement No. 4-12-1 (1948) Form 57/5001 ABC, giving exact title of position.

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Young woman. B. A. 1945, M. S. 1947.

Interested in physical, inorganic, or analytical industrial or teaching position in New York area. 3 years college teaching experience (fellowship and instructorship). 6 months summer industrial experience. ACS, AIC, Phi Beta Kappa honors. Available July first. Please reply to Box 50, THE CHEMIST.

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(New elections will be announced in the June CHEMIST)

Dr. Gustav Egloff, F.A.I.C., broadcast over WGN'S "Citizens of Tomorrow" program, March 21st. He addressed the science students of Mt. Carmel High School, Chicago, on "Youth of Today and Tomorrow in Science, Engineering, and Technology."

Dr. Donald F. Othmer, F.A.I.C., head of the Department of Chemical Engineering at the Polytechnic Institute of Brooklyn, presented two papers, giving data necessary for designing plants to make absolute alcohol, at the April meeting of the American Chemical Society in Chicago, Illinois.

Professional Services

SKF Industries announces that its branch office at Charlotte, North Carolina, is now a district headquarters with territory embracing North and South Carolina and parts of Virginia, Tennessee, and Georgia.

Foss at University of Illinois

Dr Noel E. Foss, F.A.I.C., is now assistant dean and professor of pharmacy, at the University of Illinois' College of Pharmacy, Chicago 12, Illinois.